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November 21, 2001

Mr. Jim Harris, P.E.
US EPA- Montana Operations
301 South Park, Drawer 10096
Helena, Montana 59601-0096

RE: Draft Petition for Controlled Groundwater Use Area at the BNSF Somers Site, Somers, Montana

Dear Mr. Harris:

Please find enclosed the responses to EPA and MDEQ comments, revised Attachment 1 and revised Attachment 2 of the Draft Petition for Controlled Groundwater Use Area for The Burlington Northern and Santa Fe Railway Company (BNSF) site in Somers, Montana with comments incorporated. Please advise me if the attachments are acceptable and on behalf of BNSF, RETEC(*) will submit the attachments to the Flathead City-County Health Department. The attachments submitted will be for inclusion to the petition for Controlled Groundwater Use Area at the BNSF Somers site.

Please review the revised attachments and provide comments by December 12, 2001, to allow for us to submit this petition before the end of the year. Feel free to call and discuss this information with me at (406) 652-7481.

Sincerely,

The RETEC Group, Inc.

Dan Stremcha
Operations Manager

Enclosures

cc: D. Smith, BNSF
C. Trueblood, PG&E
L. DeWitt, MDEQ
C Cosentini, RETEC
L. Carlson, RETEC

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* Effective July 30, 2001, ThermoRetec Consulting Corporation (ThermoRetec) changed its name to The RETEC Group, Inc. (RETEC) which from 12/1985 to 11/1998 performed services as Remediation Technologies, Inc. (RETEC). There have been no other changes to the legal or corporate entity of The RETEC Group, Inc. except for the name change. The RETEC Group, Inc.'s Federal ID # 04-2896814 remains the same since our company was founded in 1985 and there are no plans to change the corporate structure or relationships except for the company name.

EPA COMMENTS ON THE PETITION FOR CONTROLLED GROUNDWATER USE AREA AT THE BNSF SOMERS SITE

GENERAL COMMENTS:

1. **The petitioner is the Flathead City-County Board of Health and the Health Department is the Flathead City-County Health Department.**

   Response: Comment incorporated.

2. **Zinc should be mentioned/discussed as a contaminant of concern in the Introduction.**

   Response: Comment incorporated.

3. **The purpose and the results of the capture zone analysis should be summarized in simplified terms in Section 3.**

   Response: Comment incorporated.

4. **The Technical Impracticability Evaluation should be described briefly.**

   Response: Comment incorporated.

SPECIFIC COMMENTS:

1. **Page 1, paragraph 1, 1st sentence, Place "Montana" between "the" and "Department".**

Response: Comment incorporated.

2. **Page1, paragraph 3, 1st sentence, Replace "...supervision of ..." with " ...a Consent Decree with...".**

Response: Comment incorporated

3. **Page 3, 1st paragraph, sentence 2, Historically, Flathead Lake was the town's water supply.**

Response: *"Historically, use of the surficial aquifer did occur in areas surrounding the site, however, high iron content in the groundwater and low yield eliminated the use of many of these wells."* This sentence wasn't meant to imply that the surficial aquifer was the town's water supply. The sentence is meant to convey that the surficial aquifer had been used in the past as a source of water. But the quantity and quality of groundwater available from the surficial aquifer diminished its usefulness.

4. **Page 3, 1st paragraph, sentence 3, Change to "One of the two municipal wells...is..".**

Response: There are currently two wells used for the town of Somers drinking water supply; both are located upgradient of the Somers site and outside the boundary of the proposed CGA. The one municipal well discussed in the text and identified on the figures, was used for modeling purposes. The other municipal well identified as the yacht club well was not influenced during the Somers Town Well pump test (Retec, 1990) and was not used in the determination of the CGA.

5. **Page 7, 1st full paragraph, Please update the June 2001 report data.**

Response: Section 4.4 has been revised to incorporate the most recent groundwater data from the *March 2001* sitewide groundwater event, replacing March 2000 data. Also, to provide additional background groundwater data, historical tables of total polycyclic aromatic hydrocarbons (TPAH) and zinc data have been added to the text.

DEQ COMMENTS ON THE PETITION FOR CONTROLLED GROUNDWATER USE AREA AT THE BNSF SOMERS SITE

GENERAL COMMENTS:

1. **The petition should be submitted on the petition form provided by DNRC. It should also provide the information requested in the form. Only the attachment to the petition was provided for review.**

   Response: This draft petition was submitted to MDEQ and EPA as a **working** draft for internal review between BNSF and the agencies to convey ideas and preliminary results of modeling. The actual petition will be submitted according to DNRC guidelines.

2. **DNRC requires that well logs be provided for all wells within the proposed CGA boundary.**

   Response: See response to DEQ general comment1.

3. **How will the Technical Impracticability (TI) Evaluation work in association with the CGA? At a minimum, the CGA should acknowledge that the TI Evaluation is under development, and discuss its implications and how it would be coordinated with the proposed CGA.**

   Response: A brief discussion of the TI has been added to Section 1.

SPECIFIC COMMENTS:

1. **Page 1. Section 1. Paragraph 2. Line 17. "...insofar as groundwater would be used as drinking water supply..." Clarify why only drinking water purposes is considered.**

   Response: Site knowledge of the aquifer's limitations precludes its ability to be used for industrial or agricultural purposes. A more detailed discussion is presented in Section 4.

2. **Page 1. Section 1. Paragraph 2. Line 20. Specify which DNAPL/PAH compounds are considered contaminants of concern (COCs).**

   Response: Groundwater quality is discussed in section 4. The supporting documents provide an extensive discussion of site and regulatory history as well as a discussion of site impacts and contaminants of concern.

3. **Page 2. Section 1.1. Site History. Expand the site history section to more fully describe the activities that have taken place at the site, and to include a discussion of the ESD. Also, what have the groundwater treatment/treatment results been from the ongoing remediation activities? This information is necessary to substantiate**

whether or not the contaminant plume is expanding, stabilized, or decreasing and thus provide a basis for selecting the boundary for the CGA.

Response: A more detailed discussion of site activities and regulatory history are provided in the documents referenced in Section 1. The groundwater quality section has been revised to present historical data and a statistical summary of the groundwater quality.

4. **Page 3. Section 2.1. Paragraph 1. Line 13. "The low yield and high iron content of the surficial aquifer limit the quantity of water that can be extracted from the CERCLA lagoon or downgradient areas." How does the high iron content in the surficial aquifer limit the quantity of water that can be extracted? Please clarify.**

Response: The actual quantity of groundwater withdrawal is limited by the low yield of the alluvial aquifer. The high iron content is indicative of the poor groundwater quality in the alluvial aquifer.

5. **Page 3. Section 2.1. Paragraph 1. The beneficial use is not based on yield or iron. ARM 17.30.1006 states that the quality of Class I groundwater must be maintained so that these waters are suitable for the following beneficial uses with little or no treatment: (i) public and private water supplies; (ii) culinary and food processing purposes; (iii) irrigation; (iv) drinking water for livestock and wildlife; and (v) commercial and industrial purposes. Class I groundwaters are those groundwaters with a natural specific conductance less than or equal to 1,000 microSiemens/cm at 25 degrees C. Please take this into consideration in the discussion of beneficial use of the surficial and bedrock aquifers.**

Response: The Somers alluvial aquifer is classified as a Class II groundwater (EPA, 5 year review, February 1997). Impacted groundwater areas and the hydrogeologic conditions limit the beneficial use of the alluvial aquifer. The hydrogeologic formation does limit the yield of the aquifer for any use where more than 0.5 to 2 gpm of water is required.

6. **Page 3. Section 3. Paragraph 2. Line 33. "A typical yield capacity for domestic water use is 25 gallons per minute (gpm)." On lines 47 and 48 of page 3, it appears that the 25 gpm value is the basis for stating that "...the surficial aquifer does not supply sufficient yield for domestic use." Please specify the basis for the value of 25 gpm as a typical yield capacity for domestic water use. Given that a minimum yield capacity for domestic water use for an FHA mortgage loan is 5 gpm, 25 gpm as a typical yield capacity seems high.**

Response: The reference to a 'typical yield capacity for domestic use' has been deleted from the text. Theoretical modeling of the steady state conditions indicated that the alluvial aquifer went dry at pumping rates exceeding 7.5 to 14 gpm. Actual achievable pumping rates at the site are in the 0.5 to 2 gpm range; indicating that the alluvial aquifer does not supply sufficient yield for domestic use.

7. **Page 3. Section 3. Line 41. The text states that the model used 6 to 11 gpm. Attachment I says 1 gpm was used, and only provides figures depicting results of the 1 gpm modeling exercise. Please clarify for consistency. Include the modeling results for pumping rates exceeding 6 to 11 gpm when the well goes dry; this is not discussed in the Attachment. Also, the conclusion should not be that there is not sufficient yield for domestic use but that the contamination won't migrate, since part of the petition is based on no migration.**

Response: The text in Attachment 1 erroneously stated that the model flowpath runs were conducted with rates of 6 to 11 gpm. The model runs were conducted with pumping rates of 1 gpm in the alluvial wells. See response to DEQ comment 20.

8. **Page 3. Section 3. Paragraph 3. Line 43. "...groundwater from the impacted area would eventually be drawn into the well after a minimum of ten to one hundred years of continuous pumping." Ten to one hundred years is an awfully large range. Modify the statement as follows: "...groundwater from the impacted area could eventually be drawn into the well after a minimum of ten years of continuous pumping."**

Response: Comment incorporated.

9. **Page 7. Section 4.5. Lines 21-22. "The boundary of the proposed CGA includes the surficial aquifer only within property owned by BNSF." Why only BNSF property. The petition needs to request closure wherever groundwater exceeds or could exceed ARARs or risk-based levels, not just BNSF property. Section 1.1 talks about wells on Sliter's property also. Is there a buffer area included in this definition for the Controlled Groundwater Area?**

Response: BNSF is in the middle of a property ownership transfer. BNSF is changing land with the Sliters family so that BNSF will own all property where it has monitoring wells. The property being transferred is near the swamp area, where groundwater concentrations have been non-detect since excavation activities were completed. Groundwater concentrations exceed the ROD established risk-based levels **only** on property owned by BNSF. Figures 5 and 6 have been revised to show groundwater concentrations as well as BNSF property boundaries.

10. **Page 7. Line 2. "..., which increases the hydraulic head in the aquifer during high lake levels." As a hydraulic head on which aquifer? Please clarify.**

Response: The entire sentence reads "This data set implies that Flathead Lake acts as an external load on the confined bedrock aquifer, which increases the hydraulic head in the aquifer during high lake levels." The sentence is discussing the bedrock aquifer; clarification has been added.

11. **Page 7. Section 4.5. Paragraph 1. Lines 22 and 23. "Given that the aquifer cannot sustain a pumping rate greater than 5 to 9 gpm..." Page 3 and the discussion provided in Attachment II state that the "surficial aquifer went dry at pumping rates exceeding 6 to 11 gpm..." Please clarify the discrepancy between the two sets of pumping rates.**

Response: The reference to the '5 to 9 gpm' pumping rate was an error. The text has been revised.

12. **Page 7. Line 25. "Well pumping would not cause contaminant migration." Isn't that one of the bases for requesting a CGA? Also, the results of the modeling in Attachment 2 indicate that migration could occur in 10 to 100 years.**

    Response: This section has been changed based on revisions to the modeling.

13. **Page 7. Section 5. Paragraph 1. Lines 36-37. Until the contamination has been effectively mitigated? How does the TI Evaluation fit in with this? [See also General Comment 3.]**

    Response: At present, there is a groundwater treatment system in place at the site, to remedy the groundwater impacts as determined in the ROD and subsequent ESD's. The intent of the remedial action is to return the aquifer to background quality. Currently a technical impracticability (TI) evaluation report is being developed for the Site. The TI evaluation will demonstrate that restoration of groundwater to risk-based cleanup levels specified in the ROD is technically impracticable. See response to DEQ general comment 3. Section 6 discusses that if groundwater quality is restored to an acceptable condition, BNSF may petition to have the CGA designation removed or the size of the Area reduced.

14. **Page 7. Section 6. Paragraph 1. Lines 42 and 43. "Water quality within the surficial aquifer is not suitable for domestic, industrial, and municipal use insofar as groundwater would be used for drinking purposes." We don't want the water used for drinking --- should we also be concerned about its use (or potential use) for irrigation or for stock water?**

    Response: The next sentence states, "To protect the integrity of the site activities and reduce the potential for contaminant migration, groundwater withdrawals for other purposes must be limited." If the CGA Area is designated as requested, the surficial aquifer will be closed to all future uses except remedial activities.

15. **Page 8. Paragraph 2. "Once the site is remediated…" How does the TI Evaluation fit in to this. Does the TI in coordination with the CGA imply that the aquifer is forever closed? [See also General Comment 3.]**

    Response: See response to DEQ specific comment 13.

16. **Figure 7. This figure depicts the proposed CGA boundaries. Also include the locations of BNSF and any other wells on this figure.**

    Response: Comment incorporated.

17. **Figures. Please include contaminant concentration contour lines on the appropriate figures/maps. This information would be helpful in this document.**

Response: The contaminant concentrations are provided in Figures 5 and 6. Residual product (DNAPL) is observed in root traces and in some localized sand lenses in the surficial aquifer. DNAPL is not present throughout the soil matrix, and a discrete pool of DNAPL was not encountered during any of the investigations or remediation activities conducted at the site. NAPL has been observed in some of the extraction and injection wells sorbed to silt particles present in the water column. This area of NAPL occurrence has been added to Figures 5 and 6. Based on concentrations observed in monitoring wells, an estimated extent of dissolved PAH plume has also been established and added to Figures 5 and 6.

18. **Attachment 2. A summary table is provided for bedrock aquifer results. Include a summary table for alluvial/surficial aquifer results.**

Response: Comment incorporated.

19. **Attachment 2. Why was K=.8 ft/day used in the modeling? The average K value was corrected via modeling to be .99 ft/day (3.5×10^{-4} ft/day).**

Response: A K=0.8 ft/day was used in the original model. However, as indicated, this value was adjusted to 0.99 ft/day when the model was fit to recovery well extraction rate and groundwater level data. The model was rerun with a K=0.99 ft/day and results have been updated in Attachment 2.

20. **Attachment 2. The text of Attachment 2 states that in a model sensitivity simulation, it was determined that 6 – 11 gpm was achievable in the alluvial aquifer. Section 3 indicates that the model showed that the wells went dry in the 6 – 11 gpm scenario. This is not reflected in the discussion in Attachment 2, nor are Figures provided for the case of 6 – 11 gpm pumping.**

Response: The text in Attachment 1 (see comment 7) erroneously stated that the model flowpath runs were conducted with rates of 6 to 11 gpm. The model runs were conducted with pumping rates of 1 gpm in the alluvial wells. This achievable recovery rate is based on site-specific data. The figures provided in Attachment 2 show the results of those runs. The model was additionally run to determine what rate theoretically could be pumped from site alluvial model wells, as a model sensitivity exercise. The model computed theoretical rates that ranged from 6 to 11 gpm. Now, with the K changed from 0.8 to 0.99 ft/day (Comment 19), this range increased to 7.5 to 14 gpm. However, these are theoretical rates due to the grid sizes in the model. These rates are not achievable at actual wells at the site. The grid size causes an over-prediction in the achievable rate. This is due to the representation of a 6-inch diameter well by a 10 ft by 10 ft (at it's smallest) grid. That is why the achievable rate of 1 gpm is used in computing groundwater flowpaths and travel times. While the large grid size does not accurately predict the actual drawdown at the well (hence the over prediction in achievable rate), it does provide a good representation of the capture zone and flowpaths in the aquifer. Therefore, no figures are provided for the theoretical sensitivity runs.

TYPOGRAPHICAL/GRAMMATICAL COMMENTS:

21. **"Surficial" vs. "alluvial" aquifer. Be consistent in terminology throughout the document (i.e., use either one or the other, but not both interchangeably).**

Response: Comment incorporated.

22. **Throughout the document, change "Flathead County Department of Health" to "Flathead City-County Health Department."**

Response: See EPA general comment 1 and corresponding response.

23. **Page 1. Section 1. Paragraph 1. Line 8. Add a space between "(g)" and "MCA."**

Response: Comment incorporated.

24. **Page 1. Section 1. Paragraph 2. Line 18. After "alluvial" insert "aquifer" and after "Area" delete "aquifer."**

Response: Comment incorporated.

25. **Page 2. Paragraph 1. Line 5. Insert "CGA" between "requests a" and "designation."**

Response: Comment incorporated.

26. **Page 4. Paragraph 2. Line 15. (also Page 7. Section 5. Line 2.) "an unrealistic" – replace with either "worst case" or "conservative."**

Response: The word 'unrealistic' has been replaced with 'impractical'. It is not considered 'worst case' or 'conservative' to discuss this scenario, simply unrealistic or impractical in terms of actually being implemented.

27. **Page 4. Section 4. Paragraph 2. Sentence 1. Line 25. Change to read "The documents referenced in Section 1, provide..."**

Response: Comment incorporated.

28. **Page 5. Section 4.1. Paragraph 3. Sentence 1. Line 24. Delete "It is apparent that" and begin the sentence with "While the four units ...."**

Response: Comment incorporated.

Attachment 1: Explanation of Petition

1 Introduction

This petition requests that the Director of the Montana Department of Natural Resources and Conservation (DNRC) designate lands at The Burlington Northern and Santa Fe Railway Company (BNSF) Somers site as a controlled groundwater use area (CGA or "the Area"), pursuant to Section 85-2-506(2)(e) and (g) MCA. The Area described in this petition is located in northwestern Montana in the unincorporated town of Somers, Montana. The BNSF site occupies approximately 80 acres in Section 25, Township 27N, Range 21W of Flathead County (Figure 1). Figure 2 presents the topography of the Somers site and surrounding area; Figure 3 is the United States Geological Survey quadrangle map of the area.

The basis for this request is two-fold: (1) water quality within the alluvial aquifer underlying the proposed Area is not suited for beneficial use insofar as groundwater would be used as a drinking water supply [MCA-85-2-506(g)], and (2) groundwater withdrawals from the alluvial aquifer underlying the proposed Area may cause contaminant migration [MCA 85-2-506(g)]. The purpose of the CGA is to prevent ingestion of groundwater exceeding drinking water standards for polycyclic aromatic hydrocarbon (PAH) compounds and zinc, and to prevent uncontrolled drilling of wells that could potentially cause exposure and/or migration of the contaminants of concern.

Extensive studies of the hydrogeology and water quality characteristics of the groundwater system within the Area have been completed by BNSF under a Consent Decree with the Environmental Protection Agency (EPA) as part of several investigations in accordance with the requirements of the Comprehensive Environmental, Response, Compensation and Liability Act (CERCLA), 42 U.S.C. 9601 et seq., as amended by the Superfund Amendments and Reauthorization Act (SARA), and, to the extent practicable, the National Contingency Plan (NCP). The results of these investigations and subsequent monitoring provide the analytical data and aquifer information upon which the Flathead City-County Board of Health relies to support this petition. The following documents are provided to the DNRC with this petition. These documents support the discussion in this Explanation of Petition:

- U.S. Environmental Protection Agency, 1989. Record of Decision, Burlington Northern (Somers Plant) Superfund Site, Flathead County, Montana.
- U.S. Environmental Protection Agency, 1998. Explanation of Significant Differences, Burlington Northern (Somers Plant) Site, Flathead County, Montana.
- ThermoRetec, 2001. Phase I Groundwater Remedy Annual CERCLA Report, Somers, Montana.
- RETEC, 1990. Results of Pumping Test at Somers Tank Well, Somers, Montana.

1) 1992 ESD, add to references

Currently a technical impracticability (TI) evaluation report is being developed for the Site. The TI evaluation will show that due to the characteristics of site geology, hydrogeology and the creosote impacts in the sub-surface, restoration of groundwater to risk-based cleanup levels specified in the ROD is technically impracticable. Approval of the CGA will provide an institutional control and eliminate the groundwater exposure pathway present at the Site.

The EPA and Montana Department of Environmental Quality (MDEQ) have determined that a CGA is required to protect human health, safety, and the environment related to the potential ingestion and migration of contaminants from waste management areas. Flathead City-County Board of Health therefore requests a CGA designation, closing the underlying alluvial aquifer to further appropriation for any beneficial use. New wells within the alluvial aquifer would be limited to monitoring wells and other wells required for remedial action as directed and approved by the EPA.

1.1 Site History

BNSF operated a railroad tie treating plant in Somers, Montana from 1901 until the plant's closure in 1986. Wood preservatives used at the plant were creosote, zinc chloride, and for a short time, chromated zinc chloride. Prior to 1971, process wastewaters were discharged to a lagoon located immediately south of the treating or retort building. This lagoon, referred to as the CERCLA lagoon, overflowed to a ditch that discharged to a swampy area and then to Flathead Lake. Some groundwater monitoring wells within the CERCLA lagoon and in a portion of the swampy area contained creosote oil. Creosote oil is a dense non-aqueous phase liquid (DNAPL) and its presence poses unique difficulties to groundwater restoration. A "plume" of dissolved creosote constituents was found extending 400 to 600 feet downgradient of the CERCLA lagoon. The distribution of dissolved creosote constituents in groundwater near the CERCLA lagoon area coincides with areas of residual creosote in soil and root traces in the alluvial aquifer and the direction of groundwater flow.

Following several years of investigations, EPA issued a Record of Decision (ROD) for the Somers site in 1989, which specified the approach for soil and groundwater cleanup actions. Design of the selected remedies then proceeded; the on-site land treatment unit (LTU) and groundwater treatment system (GWTS) were constructed and cleanup was initiated in 1993.

Part of the soil remedial efforts conducted in 1993 included excavating the swamp area and the CERCLA lagoon; the excavated soils were placed on the LTU for treatment. The swamp excavation removed DNAPL-containing soils and on-going groundwater quality conditions are monitored semi-annually in this area. The CERCLA lagoon excavation removed most, but not all, of the DNAPL-containing soils. The Phase I groundwater remedy was therefore designed to address the impacted groundwater remaining after excavation. The impacted groundwater in this area is characterized by the presence of residual creosote in soil and root traces within the boundaries of the former lagoon and by dissolved constituents downgradient of the lagoon.

There is an extensive network of wells used for remedial activities at the Somers site. Currently, there are 41 monitoring wells, 6 extraction wells, 14 injection wells, and one municipal well that are all part of the ongoing site monitoring activities. With the exception of the municipal well, all the wells are maintained by BNSF and located on either BNSF property or on the adjacent property owned by the Sliter family. The municipal well is located southwest of the Somers site.

2 Petitioner Status and Groundwater Use

Section 85-2-506(2) MCA requires that "designation or modification of an area may be proposed to the board by ... petition of a state or local public health agency for identified public health risks...". Flathead City-County Board of Health, as the sole petitioner, submits that it is a qualified petitioner under this statute since it is the local public health agency for Flathead County.

2.1 Groundwater Beneficial Use

The low yield and high iron content of the alluvial aquifer limits the quantity and quality of groundwater that can be extracted from the CERLCA lagoon or downgradient areas. Historically, use of the alluvial aquifer did occur in areas surrounding the site, however, high iron content in the groundwater and low yield eliminated the use of many of these wells. A new municipal water supply was installed due to increased water demands in the town of Somers. The municipal well (Figure 1) is located upgradient of the Site and outside the boundaries of the proposed CGA. The present beneficial use of the alluvial aquifer at the Somers site is for recharge of Flathead Lake. The present beneficial use of the bedrock aquifer is for the Somers municipal water supply.

3 Description of Area Boundary

The CGA includes only BNSF property in Section 25, Township 27N, Range 21W of Flathead County. The CGA boundary was determined by conducting a capture zone analysis using site-specific aquifer parameters and the groundwater flow modeling program, MODFLOW (Attachment 2). The capture zone analysis included hypothetical wells with varying pumping rates and permeabilities representative of site conditions. The hypothetical wells were placed at the BNSF property boundaries around the site, and simulations were run for pumping from either the alluvial or the bedrock aquifer. The purpose of the modeling was to determine the travel time and path a groundwater particle would follow, under continuous pumping conditions. The model was used to predict whether pumping would cause migration of groundwater from the impacted areas to the property boundary.

Alluvial Aquifer

According to the model, pumping from the alluvial aquifer at a constant rate of 1 gpm, groundwater from the impacted area could eventually be drawn into the well after a minimum of ten years of continuous pumping. The modeled flow time represents transport time for a groundwater particle, whereas the transport time for the PAHs dissolved in the groundwater would generally be greatly retarded in comparison. Modeling of the steady state conditions indicated that the alluvial aquifer went dry at pumping rates exceeding 7.5 to 14 gpm; indicating that the alluvial aquifer does not supply sufficient yield for domestic use. However, these are theoretical rates based on a model limitation whereby a 6-inch diameter well is represented by a 10 by 10 ft grid in the model, which clearly over-predicts the achievable pumping rate. Actual achievable pumping rates at the site are in the 0.5 to 2 gpm range based on actual groundwater extraction rate and aquifer drawdown data generated through operation of the Phase I groundwater remedy (Phase I Groundwater Remedy Annual CERCLA Report, Somers, Montana, ThermoRetec, 2000). Therefore, this petition requests the alluvial aquifer be closed based on the lack of beneficial use due to low yield and the possibility of contaminant transport. Closing the alluvial aquifer will not be limiting groundwater resources based on the lack of availability of groundwater at sustainable pumping rates from the alluvial aquifer.

Bedrock Aquifer

Modeling of the bedrock aquifer indicates that with continuous pumping at 100 gpm, no groundwater would be drawn from the alluvial aquifer to the bedrock aquifer. According to the model, pumping at 500 gpm, groundwater could theoretically be drawn from the alluvial aquifer to the bedrock aquifer after 10 years of continuous pumping. This means pumping from the bedrock aquifer at a constant rate of 500 gpm, impacted groundwater from the alluvial aquifer could eventually be drawn into the bedrock aquifer after a minimum of ten years of continuous pumping. However, as discussed above, the flow time represents a transport time for a groundwater particle, whereas the transport time for any PAHs dissolved in the groundwater would generally be greatly retarded in comparison. Therefore, based on the 500 gpm modeling results, which represents an impractical groundwater use scenario, this petition does not include a restriction on the bedrock aquifer.

4 Groundwater Conditions

The geology and hydrogeology of the Somers site have been thoroughly characterized in numerous investigations. Data from nearly 100 monitoring wells, borings, piezometers, and test pits, six extraction wells and 14 injection wells comprise the database used to describe the stratigraphy and hydrogeologic regime at Somers.

The documents referenced in Section 1 provide site-specific information supporting the selected remedial actions for the Somers Site. This petition summarizes aquifer and water quality characteristics:

- Groundwater flow occurs under water table conditions in the low permeability, fine-grained, sandy to clayey silt alluvial aquifer.
- Within the alluvial aquifer, groundwater flow occurs predominantly through interbedded sand lenses, however, since the sand lenses are thin and discontinuous, the groundwater flow paths are not uniform, but rather short and tenuous.
- Groundwater in the alluvial aquifer in the site vicinity is not used as a potable source due to low yield, high iron and availability of a municipal water supply.

- The alluvial aquifer grades downward into silty clay with no sand lenses from approximately 65 to 100 feet, below which lies bedrock. DNAPL was not observed in sand lenses occurring at depths greater than about 45 feet below ground surface (bgs).
- Recharge to the alluvial aquifer occurs via infiltration of precipitation and recharge from Flathead Lake during high lake levels.
- The net groundwater flow direction across the site is generally to the east.

4.1 Geology

The geology of Somers is complex due to the interbedded nature of sediments resulting from various depositional environments. The Somers site is located in Flathead Valley and consists of glacial deposits from the Salish Mountains as well as fluvial deposits reworked by the Flathead River. Furthermore, much of the site from Somers Road to the former swamp pond is believed to have been previously covered by Flathead Lake. As a result of these depositional environments, the geology consists of fine-grained, discontinuous and interbedded silt, sand and clay stratigraphy.

The stratigraphy underlying the site has been subdivided into four units. The upper unit is comprised of fill up to 10 feet thick and consists primarily of gravel with some sand, silt, and clay. The fill is underlain by a unit consisting of sandy silt and silty sand that ranges in thickness from 0 to 25 feet, which decreases in thickness towards the lake. The upper portion of this unit is sandy silt and grades downward into silty sand. Discontinuous well-sorted sand lenses are present in this layer. Underlying this sandy silt layer is a 60 to 70 foot thick finer-grained unit primarily comprised of silt with some fine-grained sands and clays. Thin, occasional and discontinuous sand lenses are present to depths of approximately 45 feet bgs. Finally, this fine-grained unit is underlain by Precambrian bedrock. Based on visual observation of the outcrops west of the site, the Precambrian bedrock is believed to be gray, silty, stromatolite-bearing dolomite, a part of the Piegan Group.

While the four units described above are generally present, distinct contacts between the units are not always apparent. In some areas of the site, slight gradational changes may be the only distinguishing feature between two units with similar grain size. This lack of distinct layering and discontinuous nature of the sediments suggest the reworking of the underlying glaciolacustrine materials, which are responsible for the complex and heterogeneous geology at Somers.

4.2 Hydrogeology

Two distinct aquifers have been identified at Somers: the alluvial aquifer and the bedrock aquifer.

Alluvial Aquifer

The alluvial aquifer is a water table aquifer with low hydraulic conductivity that occurs within the fine-grained interbedded silt, clay, and sand. Groundwater flow occurs predominantly through the sand lenses. However, since the sand lenses are thin and discontinuous, the groundwater flow paths are not uniform, but rather short and tenuous. The limited paths available for groundwater flow in combination with the overall low permeability result in low water yield.

The hydraulic conductivity of the area downgradient of the CERCLA lagoon area was calculated to range from 5.7×10^{-3} to 7.39×10^{-4} cm/sec with an average conductivity of 1.46×10^{-3} cm/sec. Groundwater modeling was performed based on actual groundwater extraction rate and aquifer drawdown data generated through operation of the Phase I groundwater remedy (Phase I Groundwater Remedy Annual CERCLA Report, Somers, Montana, ThermoRetec, 2000). Results of this groundwater modeling indicate a conductivity value of 3.5×10^{-4} cm/sec; which is the most reasonable value for characterization of flow at the site.

During the constant-discharge tests the maximum sustainable pumping rate in the wells downgradient of the CERCLA lagoon area varied from 0.5 gallons per minute (gpm) to 2.0 gpm at a 100-foot distance. This variability is indicative of the heterogeneity of the site geology, particularly as it pertains to the location and areal extent of the sand lenses. The sand lenses, although limited in size and interconnectedness, are believed to be the primary pathways for the limited groundwater flow that occurs in this area.

Bedrock Aquifer

The bedrock aquifer exists under confined to semiconfined conditions and occurs within the fractured bedrock and overlying gravels. Konizeski (1968) studied the groundwater resources near the study area. The oldest aquifer is the Precambrian bedrock aquifer. The Precambrian bedrock aquifer is associated with secondary bedrock features, i.e., joints and fractures. These features have small storage capacities but serve as conduits for water supplied from precipitation and leakage from aquifers. Konizeski identified wells drilled into bedrock where the bedrock crops out or is overlain by shallow deposits of soil. These wells are located primarily along the east and west shores of Flathead Lake where the aquifer yields water for domestic use. However, Konizeski concludes that it is not the source of large groundwater supplies on a regional scale. Konizeski reports that this aquifer is tapped by a well near the Somers site, and is presumed to be the Somers School well. The well is reported to be 467 feet deep, penetrating bedrock for 185 feet and produces 33 gallons per minute with a drawdown of 97 feet.

4.3 Groundwater Movement

Horizontal Gradient

Groundwater in the alluvial aquifer in northwestern portion of the Site flows northeasterly towards the slough (Figure 4). In this area, the water table is not affected by water level fluctuations in Flathead Lake. In the vicinity of the CERCLA lagoon, groundwater flows southeast towards Flathead Lake. The water table in this area of the site is affected by the water level in Flathead Lake. Groundwater is encountered at a depth of approximately 16 to 18 feet bgs in the area of the former CERCLA lagoon and the LTU, and a depth of approximately 2 feet bgs near Flathead Lake. The seasonal groundwater table fluctuation at the site is approximately 1 foot.

Vertical Gradient

Based on semi-annual water level measurements from the past 9 years, the bedrock and alluvial aquifer show a pattern of the bedrock aquifer recharging the alluvial aquifer in the fall and to a lesser degree the alluvial aquifer recharging the bedrock aquifer in the spring. Water levels in the deep bedrock wells fluctuate in direct response to the level of Flathead Lake, whereas the alluvial wells respond inversely. This data implies that Flathead Lake acts as an external load on the confined bedrock aquifer, which increases the hydraulic head in the bedrock aquifer during high lake levels.

4.4 CGA Groundwater Quality

A comprehensive groundwater monitoring program has been established and maintained at the Somers site since 1992. The monitoring program includes semi-annual sitewide and quarterly treatment area groundwater quality events for PAH compounds and zinc. The most recent reporting period was from April 2000 through March 2001 (Phase I Groundwater Remedy Annual CERCLA Report, Somers, Montana, ThermoRetec, 2001). Figures 5 and 6 present the most recent site-wide groundwater data from September 2000 and March 2001 respectively. Groundwater treatment goals established for the site are 40 μg/L for total PAH compounds and 5 mg/L for zinc.

Since implementation of the selected groundwater remedy, the following wells have had observable total PAH concentrations greater than the target cleanup level of 40 μg/L: S-88-1, S-88-2, S-88-3, MW-93-2S and MW-93-2D, all located in the treatment area and well S-6, located north of the treatment area. The distribution of dissolved PAHs in the CERCLA lagoon area coincides with areas of residual creosote in soil and root traces and the direction of groundwater flow. Historical TPAH concentrations from June 1984 through March 2001 are presented in Table 1.

A statistical review of groundwater data is performed annually (ThermoRetec, 2001). Historical TPAH concentrations from June 1984 through March 2001 (Table 1) were used to conduct the statistical analyses to determine if the data represents trends in groundwater quality. Five monitoring wells (S-6, S-88-2, S-88-3, S-93-2S, and S-93-2D) were tested for seasonality and trend in TPAH concentrations. There was a statistically significant downward trend in TPAH in well S-88-3, and a statistically significant upward trend in well S-93-2D. This trend in well S-93-2D appears to be a result of unusually high TPAH values in June 1999 and June 2000 and is considered to be an anomaly. There was no evidence of a trend in TPAH concentrations in any of the other wells. The downward trend in well S-88-3 is indicative of TPAH concentration in both of the S-88 wells that were analyzed.

Historical zinc concentrations from February 1986 through March 2001 are presented on Table 2. Review of data demonstrates a variation of zinc concentrations in wells across the site with no apparent correlation to a potential source area or temporal trends.

Review of Figures 5 and 6 indicate all impacted wells are on BNSF property with the exception of well S-91-2, located downgradient of the CERCLA area. Historical TPAH and zinc concentrations from well S-91-2 have not exceeded the target cleanup levels. Table 3 presents historical summary analytical data from well S-91-2; naphthalene is the only compound reported in the calculation of TPAH. Comparison of the WQB-7 level for naphthalene against concentrations in S-91-2, indicates that naphthalene concentrations are all below the WQB-7 level (28 μg/L).

4.5 CGA Boundary Conditions

The boundary of the proposed CGA includes the alluvial aquifer only within property owned by BNSF (Figure 7). This area was determined based on the fact that groundwater within the alluvium is not suited for beneficial use insofar as groundwater would be used as a drinking water supply. In addition, pumping from the alluvial aquifer may cause contaminant migration based on modeling results in Attachment 2.

The low yield and high iron content of the alluvial aquifer limits the quantity and quality of groundwater that can be extracted from the CERLCA lagoon or downgradient areas. Modeling predicted with pumping at 1 gpm within the alluvial aquifer, that groundwater would eventually be drawn from the impacted area into a hypothetical well placed at the boundary after a minimum of ten years of continuous pumping.

Additionally, a remote possibility exists for groundwater migration from the alluvial to bedrock aquifer and possible contaminant transport under continuous pumping conditions of 500 gpm over a period of 10 years. Due to this impractical groundwater use scenario, the bedrock aquifer is not included within the boundary of the CGA based on modeling.

5 Existing and Future Wells

There is an extensive network of wells used for remedial activities indicated in Figure 7 that are inside the proposed Area. As stipulated in the groundwater controls outlined herein, there will be no future additional wells permitted within the proposed boundary (except for remedial action activities) until the groundwater is restored to acceptable conditions at the Somers site. Any new wells within the Area shall be designed and installed in accordance with the DNRC Well Construction Standards.

6 Proposed Groundwater Controls

Water quality within the alluvial aquifer is not suitable for domestic, industrial, and municipal use insofar as groundwater would be used for drinking purposes. To protect the integrity of the site activities and reduce the potential for contaminant migration, groundwater withdrawals for other purposes must be limited. Therefore, Flathead City-County Board of Health requests that the Director of the Montana DNRC designate the area delineated in Figure 7 as a CGA. Flathead City-County Board of Health requests that the Director enter an order closing the alluvial aquifer within the Area to further appropriation until groundwater is restored to acceptable conditions. The closure order would allow monitoring wells and new appropriations that are required for remedial action as directed and approved by the EPA.

Once the Site is remediated and the groundwater is restored to acceptable conditions, the petitioner or other qualifying petitioners may request the Controlled Groundwater Area designation be lifted or reduced in size. A primary objective of the agencies is to make the restricted groundwater resource available to the community at the earliest opportunity.

Table 1
Total PAH Concentrations (ug/L)
Historical Data (1984-2001)
BNSF Tie Plant - Somers, MT

Well Number	June 1984	July 1984	Feb 1986	June 1986	Nov 1986	March 1987	June 1987	Oct 1987	Dec 1987	March 1988	June 1988	July 1988	Aug 1988	Sept 1988	Dec 1988	March 1989	June 1989	Sept 1989	Dec 1989	March 1990
S-1	---	---	---	< 1	< 1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-2	116	0.151	< 5	< 1	< 1	---	---	---	---	---	A	A	A	A	A	A	A	A	A	A
*S-3 / S-3R	1.172	0.479	< 5	< 1	< 1	< 1	< 1	< 1	< 2	< 3	< 1	---	---	< 1	< 1	< 1	< 1	< 1	< 1	< 1
S-4	1.952	1.102	< 5	< 1	< 1	< 1	< 1	< 1	< 2	< 2	< 1	---	---	< 1	< 1	< 1	< 1	< 1	< 1	< 1
*S-5 / S-5R	1.355	0.571	< 5	< 1	< 1	< 1	< 1	< 1	< 2	< 2	< 1	---	---	< 1	< 1	< 1	< 1	< 1	< 1	---
S-6	---	---	< 5	< 1	< 1	---	---	---	---	---	---	---	---		---	---	---	---	---	---
S-8	---	---	---	< 1	< 1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-84-1	---	---	**17,250**	---	**3,900**	---	---	---	---	---	A	A	A	A	A	A	A	A	A	A
S-84-3	---	---	**18,280**	---	---	---	---	---	---	---	A	A	A	A	A	A	A	A	A	A
S-84-4	---	---	---	< 1	< 1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-84-5	---	---	---	< 1	< 1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-84-6	---	---	---	30	< 1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-84-9	---	---	---	< 1	< 1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-84-10	---	---	---	< 1	< 1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-84-11	**188**	**154**	10	< 1	< 1	18	**44**	**300**	**1,200**	**1,200**	**1,100**	---	---	**830**	**390**	**47**	< 1	4	3	< 1
S-84-14	---	---	---	---	---	---	---	---	---	**414,400**	---	---	---	---	---	---	---	---	---	---
S-84-15	---	---	---	< 2	< 1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-84-16	---	---	---	< 1	< 1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-85-1B	---	---	---	< 1	< 1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-85-2	---	---	---	< 1	< 1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-85-3	---	---	< 5	< 1	< 1	< 1	< 1	< 1	< 2	< 2	< 2	---	---	< 1	< 1	< 1	< 1	< 1	< 1	< 1
S-85-4A	---	---	< 5	< 1	< 1	---	< 1	---	< 2	< 2	A	A	A	A	A	A	A	A	A	A
S-85-4B	---	---	< 5	< 2	< 1	< 1	< 1	< 1	< 2	< 2	A	A	A	A	A	A	A	A	A	A
S-85-4C	---	---	< 5	< 1	< 1	< 1	< 1	< 1	< 2	< 2	A	A	A	A	A	A	A	A	A	A
S-85-5A	---	---	< 5	< 1	< 1	< 1	< 1	< 1	< 2	< 2	---	---	---	---	---	---	---	---	---	---
S-85-5B	---	---	< 5	< 1	< 1	< 1	< 1	< 1	< 2	< 2	---	---	---	---	---	---	---	---	---	---
S-85-6A	---	---	---	< 1	< 1	---	---	---	---	---	< 1	---	---	---	---	---	---	---	---	---
S-85-6B	---	---	---	< 1	< 1	---	---	---	---	---		---	---	---	---	---	---	---	---	---
S-85-7	---	---	< 5	< 1	< 1	---	---	---	---	< 2	< 1	< 2	< 2	---	---	---	---	---	---	---
S-85-8A	---	---	< 5	< 1	< 1	---	---	---	---	---	---	< 2	< 2	---	---	---	---	---	---	---
S-85-8B	---	---	---	< 1	< 1	---	---	---	---	---	---	< 2	< 2	---	---	---	---	---	---	---
S-86-1	---	---	---	---	< 1	< 1	< 1	< 1	< 3	< 2	< 1	---		< 1	< 1	< 1	< 1	< 1	< 1	< 1
S-88-1	---	---	---	---	---	---	---	---	---	---	**559**	**256**	**1,795**	---	---	---	---	---	---	---
S-88-2	---	---	---	---	---	---	---	---	---	---	**2,123**	**503**	**3,779**	---	---	---	---	---	---	---
S-88-3	---	---	---	---	---	---	---	---	---	---	**150**	**130**	**67**	---	---	---	---	---	---	---
S-91-1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-91-2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-91-3	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-91-4	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-93-2S	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-93-2D	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-93-5S	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-93-5D	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-93-7	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-95-1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
*SP-11 / SP-10	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
TW-1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
TW-2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Swamp Pond	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

--- = Not sampled.
* = S-5 replaced by S-5R during Summer 1993, SP-10 replaced SP-11 during Fall 1996,
and S-3R replaced S-3 during Fall 1999.
Target Cleanup Level = 40 ug/L. Exceedences are bolded.
DUP = duplicate sample taken, highest concentration reported
A = abandoned

Table 1 (continued)
Total PAH Concentrations (ug/L)
Historical Data (1984-2001)
BNSF Tie Plant - Somers, MT

Well Number	Sept 1990	March 1991	Sept 1991	March 1992	Sept 1992	March 1993	Sept 1993	March 1994	August 1994	Nov 1994	March 1995	May 1995	Sept 1995	Dec 1995	April 1996	June 1996	Aug 1996	Dec 1996	May 1997
S-1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-2	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
*S-3 / S-3R	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	---	< 1	---	< 1	---	< 1	---	< 1	< ---	< 1
S-4	**582**	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	---	< 1	---	< 1	---	< 1	---	< 1	< ---	< 1
*S-5 / S-5R	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	---	< 1	---	< 1	---	< 1	---	< 1	< ---	< 1
S-6	---	---	---	---	---	---	< 1	< 1	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1
S-8	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-84-1	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
S-84-3	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
S-84-4	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-84-5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-84-6	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-84-9	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-84-10	---	---	---	---	---	---	---	< 1	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1
S-84-11	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1
S-84-14	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-84-15	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-84-16	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-85-1B	< 1	---	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
S-85-2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-85-3	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1
S-85-4A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
S-85-4B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
S-85-4C	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
S-85-5A	---	---	---	---	---	---	< 1	< 1	< 1	---	< 1	---	< 1	---	< 1	---	1.3	---	< 1
S-85-5B	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-85-6A	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	< 1	---	---
S-85-6B	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	2	---	---
S-85-7	< 1	---	---	< 1	< 1	< 1	---	< 1	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1
S-85-8A	< 1	---	---	---	---	---	< 1	< 1	1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1
S-85-8B	< 1	---	---	< 1	< 1	---	---	< 1	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1
S-86-1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	---	---	---	---	---	---	---	---	---	---
S-88-1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	**900**	---	---
S-88-2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	**1,377**	---	**431**
S-88-3	< 1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	**400**	---	**380**
S-91-1	---	---	---	< 1	< 1	< 1	< 1	< 1	< 1	---	< 1	---	< 1	---	4.6	---	< 1	---	< 1
S-91-2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-91-3	---	---	---	< 1	< 1	< 1	< 1	< 1	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1
S-91-4	---	---	---	< 1	< 1	< 1	< 1	< 1	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1
S-93-2S	---	---	---	---	---	---	---	---	**3,915**	**1,568**	**9,786**	**901**	**1,085**	**1,079**	**1,044**	**5,367**	**868**	**1,539**	**401**
S-93-2D	---	---	---	---	---	---	---	---	2	2	**1,300**	33	5	4	2	1	**191**	35	13
S-93-5S	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-93-5D	---	---	---	---	---	---	---	---	**533**	**305**	**50**	**87**	**129**	---	---	---	---	---	---
S-93-7	---	---	---	---	---	---	< 1	< 1	< 1	---	< 1	---	1	---	< 1	---	< 1	---	< 1
S-95-1	---	---	---	---	---	---	---	---	---	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1
*SP-11 / SP-10	---	---	---	---	---	---	15	9	6	---	< 1	---	**641**	---	**243**	---	< 1	---	< 1
TW-1	---	---	---	---	---	---	---	0.012	0.017	---	0.027	---	< 0.01	---	0.012	---	---	---	< 1
TW-2	---	---	---	---	---	---	---	0.014	0.018	---	< 0.01	---	< 0.01	---	< 1	---	---	---	< 1
Swamp Pond	---	---	---	---	---	---	---	< 1	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1

--- = Not sampled.

* = S-5 replaced by S-5R during Summer 1993, SP-10 replaced SP-11 during Fall 1996, and S-3R replaced S-3 during Fall 1999.

Target Cleanup Level = 40 ug/L. Exceedences are bolded.

DUP = duplicate sample taken, highest concentration reported

A = abandoned

Table 1 (continued)
Total PAH Concentrations (ug/L)
Historical Data (1984-2001)
BNSF Tie Plant - Somers, MT

Well Number	June 1997	Sept 1997	Dec 1997	March 1998	June 1998	Sept 1998	Dec 1998	Mar 1999	June 1999	Sept 1999	Dec 1999	March 2000	June 2000	Sept 2000	Nov 2000	March 2001
S-1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-2	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
*S-3 / S-3R	---	< 1	---	< 1	---	< 1	---	< 1	---	0.11	---	< 1	---	< 1	---	< 1
S-4	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1
*S-5 / S-5R	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1
S-6	---	< 1	---	3	---	**570**	**480**	**360**	**320**	**600**	**460**	**530**	< 1	17	< 1	< 1
S-8	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-84-1	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
S-84-3	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
S-84-4	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-84-5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-84-6	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-84-9	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-84-10	---	< 1	---	2	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1
S-84-11	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1
S-84-14	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-84-15	---	---	---	---	---	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	---	---	---
S-84-16	---	---	---	---	---	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
S-85-1B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
S-85-2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-85-3	---	< 1	---	< 1	---	< 1	---	6	---	< 1	---	DUP < 1	---	DUP < 1	---	< 1
S-85-4A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
S-85-4B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
S-85-4C	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
S-85-5A	---	< 1	---	< 1	---	2	< 1	7	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
S-85-5B	---	---	---	---	---	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
S-85-6A	---	---	---	---	---	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
S-85-6B	---	---	---	---	---	< 1	< 1	< 1	< 1	< 1	< 1	DUP < 1	< 1	DUP 1	DUP < 1	DUP < 1
S-85-7	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1
S-85-8A	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1
S-85-8B	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	DUP 1.2	---	DUP < 1	---	DUP < 1
S-86-1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-88-1	---	---	---	**12,828**	---	**6,907**	---	**8,613**	---	**12,381**	**11,339**	**6,901**	---	**5,615**	---	**8,287**
S-88-2	---	**465**	---	**1,361**	---	**478**	**698**	**331**	**159**	**881**	**720**	**59**	**290**	**56**	**85**	**55**
S-88-3	---	**350**	---	**490**	---	**360**	**310**	**140**	**100**	< 1	40	**54**	**72**	22	38	**50**
S-91-1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1
S-91-2	---	---	---	---	---	---	---	---	---	---	---	3.3	---	4	2.1	2
S-91-3	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1
S-91-4	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	DUP < 1	---	DUP < 1	---	DUP < 1
S-93-2S	**911**	**2,561**	**609**	**1,155**	**1,267**	**2,000**	**412**	**2,912**	**4,058**	**1,922**	**1,397**	**2,387**	16	**859**	**426**	**816**
S-93-2D	< 1	8	32	14	24	**392**	21	**503**	**2,712**	**101**	**65**	**42**	**771**	28	29	20
S-93-5S	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-93-5D	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-93-7	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	DUP < 1	---	DUP < 1	---	< 1
S-95-1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	DUP < 1
*SP-11 / SP-10	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1
TW-1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1
TW-2	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1
Swamp Pond	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1	---	< 1

' S-6 Resample collected in October 1998 was 430 ug/L

--- = Not sampled.

* = S-5 replaced by S-5R during Summer 1993, SP-10 replaced SP-11 during Fall 1996, and S-3R replaced S-3 during Fall 1999.

Target Cleanup Level = 40 ug/L. Exceedences are bolded.

Note: Well S-91-2 was sampled in April 2000.

Table 2
Historic Zinc Concentrations (mg/L)
1986-2001
BNSF - Somers, MT

Well Number	Feb 1986	June 1986	Nov 1986	Mar 1987	June 1987	Sept 1987	Dec 1987	Mar 1988	June 1988	July 1988	Aug 1988	Sept 1988	Dec 1988	Mar 1989	June 1989	Sept 1989	Dec 1989	Mar 1990	Sept 1990
S-1	---	1.900	0.480	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-2	**13.000**	4.100	2.300	---	---	---	---	---	A	A	A	A	A	A	A	A	A	A	A
S-3 / S-3R	4.600	0.640	1.400	0.055	0.017	0.022	0.066	0.022	0.015	---	---	0.021	0.012	0.008	0.011	0.009	0.004	0.006	0.350
S-4	**15.000**	**7.600**	2.000	0.160	0.081	0.047	0.066	0.047	0.044	---	---	0.034	0.036	0.031	0.023	0.025	0.020	0.021	0.110
S-5 / S-5R	2.800	2.900	2.500	0.160	0.017	0.022	0.066	< 0.022	0.006	---	---	0.012	0.006	0.004	0.052	0.007	0.005	---	0.360
S-6	0.460	0.290	1.300	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-8	---	**6.700**	1.200	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-84-1	0.210	---	0.220	---	---	---	---	---	A	A	A	---	---	A	A	A	A	A	A
S-84-3	0.034	---	---	---	---	---	---	---	A	A	A	---	---	A	A	A	A	A	A
S-84-4	---	0.079	0.490	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-84-5	---	0.420	0.140	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-84-6	---	0.063	0.022	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-84-9	---	0.035	0.024	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-84-10	---	0.042	0.058	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-84-11	1.100	0.790	0.240	0.012	0.012	0.011	0.005	< 0.002	0.005	---	---	< 0.002	0.013	0.005	0.008	0.005	0.004	0.004	0.990
S-84-14	---	---	---	---	---	---	---	---		---	---	---	---	---	---	---	---	---	---
S-84-15	---	0.068	0.460	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-84-16	---	0.028	0.032	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-85-1b	---	**12.000**	**8.300**	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	2.100
S-85-2	---	**21.000**	2.900	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-85-3	**24.000**	**17.000**	**25.000**	0.470	0.320	0.260	0.210	0.230	0.220	---	---	0.120	0.200	1.000	0.120	0.160	0.160	0.090	0.005
S-85-4a	0.830	0.750	0.410	---	0.014	---	0.350	0.024	A	A	A	A	A	A	A	A	A	A	A
S-85-4b	**11.000**	**30.000**	**6.200**	0.510	0.390	0.560	0.910	0.440	A	A	A	A	A	A	A	A	A	A	A
S-85-4c	**49.000**	**24.000**	**8.400**	**8.900**	3.800	**6.300**	2.700	4.900	A	A	A	A	A	A	A	A	A	A	A
S-85-5a	**20.000**	2.300	2.500	0.250	0.150	0.100	0.090	0.170	---	---	---	---	---	---	---	---	---	---	---
S-85-5b	**20.000**	3.600	**20.000**	1.300	0.420	0.540	0.200	0.380	---	---	---	---	---	---	---	---	---	---	---
S-85-6a	---	**28.000**	**44.000**	---	---	---	---	---	**59.000**	---	---	---	---	---	---	---	---	---	---
S-85-6b	---	**42.000**	**6.100**	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-85-7	0.640	1.300	2.800	---	---	---	---	**5.900**	1.600	0.680	0.990	---	---	---	---	---	---	---	2.000
S-85-8a	2.900	3.100	4.100	---	---	---	---	---	---	**9.200**	**15.000**	---	---	---	---	---	---	---	**16.000**
S-85-8b	---	2.700	2.700	---	---	---	---	---	---	0.590	1.000	---	---	---	---	---	---	---	1.500
S-86-1	---	---	**8.500**	0.610	---	---	0.330	0.360	0.390	---	---	0.180	0.280	0.110	0.460	0.410	0.500	0.150	0.003
S-88-1	---	---	---	---	---	---	---	---	0.051	0.047	0.027	---	---	---	---	---	---	---	---
S-88-2	---	---	---	---	---	---	---	---	0.350	0.370	0.012	---	---	---	---	---	---	---	---
S-88-3	---	---	---	---	---	---	---	---	0.650	0.350	0.015	---	---	---	---	---	---	---	0.020
S-91-1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-91-2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-91-3	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-91-4	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-93-2D	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-93-2S	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-93-7	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-95-1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
SP-11 / SP-10	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
TW-1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
TW-2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Swamp Pond	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

A = Abandoned.

--- = not sampled.

DUP = duplicate sample taken, highest concentration reported

* = S-5 replaced by S-5R during Summer 1993, SP-10 replaced SP-11 during Fall 1996, and S-3R replaced S-3 during Fall 1999.

Target cleanup level = 5 mg/L

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Table 2 (Continued)
Historic Zinc Concentrations (mg/L)
1986-2001
BNSF - Somers, MT

Well Number	Mar 1991	Sept 1991	Mar 1992	Sept 1992	Mar 1993	Sept 1993	Mar 1994	Aug 1994	Mar 1995	Sept 1995	Mar 1996	Aug 1996	Sept 1996	Mar 1997	May 1997	Sept 1997
S-1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-2	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
S-3 / S-3R	0.010	0.005	0.007	0.021	0.022	0.021	0.017	0.026	0.095	0.561	0.111	---	DUP 0.120	DUP 0.092	---	0.765
S-4	0.021	0.023	0.018	0.034	0.036	0.018	0.250	0.180	2.310	3.240	DUP 0.098	---	0.055	0.030	---	DUP 0.866
S-5 / S-5R	0.003	0.045	0.005	0.013	0.019	0.011	0.005	0.004	0.008	0.013	DUP 0.008	---	0.016	---	< 0.004	0.076
S-6	---	---	---	---	---	0.640	0.180	0.032	DUP 0.419	DUP 0.228	0.127	---	DUP 0.486	---	0.088	3.310
S-8	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-84-1	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
S-84-3	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
S-84-4	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-84-5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-84-6	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-84-9	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-84-10	---	---	---	---	---	0.026	0.033	0.014	0.019	0.051	0.035	---	0.019	---	0.015	0.118
S-84-11	0.008	0.003	< 0.002	0.007	0.014	0.005	0.003	0.009	0.146	0.173	0.040	---	0.017	0.026	---	0.215
S-84-14	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-84-15	---	---	---	---	---	---	---	---	---	---	---	0.013	---	---	---	---
S-84-16	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-85-1b	1.800	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
S-85-2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-85-3	0.230	0.230	0.410	0.290	0.150	0.180	0.250	0.360	DUP **8.480**	DUP **8.090**	0.168	---	0.423	0.266	---	1.460
S-85-4a	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
S-85-4b	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
S-85-4c	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
S-85-5a	---	---	---	---	---	4.400	2.800	2.000	3.810	2.600	0.771	---	1.030	---	0.512	0.395
S-85-5b	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-85-6a	---	---	---	---	---	---	---	---	---	---	---	0.683	---	---	---	---
S-85-6b	---	---	---	---	---	---	---	---	---	---	---	**12.100**	---	---	---	---
S-85-7	1.400	---	0.600	0.500	0.650	0.400	0.740	0.500	**12.000**	0.506	0.326	---	DUP 2.110		DUP 2.410	2.820
S-85-8a	**9.400**	---	---	---	---	**8.000**	**8.800**	2.300	**10.900**	**19.800**	**7.610**	---	**15.200**	---	4.100	**6.100**
S-85-8b	1.100	---	0.094	0.150	0.420	0.180	0.690	0.220	0.255	1.900	DUP 4.110	---	DUP 0.570	---	0.720	DUP 0.529
S-86-1	0.750	1.600	1.200	1.000	1.000	0.840	1.200	2.600				---	---	---	---	---
S-88-1	---	---	---	---	---	---	---	---	---	---	---	0.098	---	---	---	---
S-88-2	---	---	---	---	---	---	---	---	---	---	---	0.030	---	---	0.039	0.045
S-88-3	0.069	---	---	---	---	---	---	---	---	---	---	0.018	---	---	3.130	1.940
S-91-1	---	---	< 0.002	0.008	0.045	0.007	0.007	0.006	0.015	0.018	0.006	---	< 0.004	---	DUP 0.008	< 0.019
S-91-2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-91-3	---	---	0.009	0.004	0.038	0.007	0.003	0.005	DUP 0.004	0.013	DUP 0.004	---	< 0.004	---	0.005	DUP 0.009
S-91-4	---	---	0.013	0.017	0.010	0.007	0.004	0.004	0.006	0.008	< 0.004	---	DUP 0.007	---	0.006	0.010
S-93-2D	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-93-2S	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S-93-7	---	---	---	---	---	0.038	0.003	0.009	0.026	0.084	0.010	---	0.026	---	DUP 0.005	DUP 0.168
S-95-1	---	---	---	---	---	---	---	---	0.107	0.004	< 0.004	---	0.017	0.007	---	0.130
SP-11 / SP-10	---	---	---	---	---	0.420	0.260	0.220	0.269	0.397	0.092	---	0.014	---	0.077	0.027
TW-1	---	---	0.100	0.085	0.092	0.039	0.038	0.034	---	0.054	0.036	---	0.044	0.034	---	0.057
TW-2	---	---	---	---	---	---	---	---	---	---	---	---	0.025	---	---	---
Swamp Pond	---	---	---	---	---	---	---	0.003	0.009	0.011	0.009	---	0.026	---	0.030	0.008

A = Abandoned.

--- = not sampled.

DUP = duplicate sample taken, highest concentration reported

* = S-5 replaced by S-5R during Summer 1993, SP-10 replaced SP-11 during Fall 1996, and S-3R replaced S-3 during Fall 1999.

Target cleanup level = 5 mg/L

Table 2 (Continued)
Historic Zinc Concentrations (mg/L)
1986-2001
BNSF - Somers, MT

Well Number	Mar 1998	Sept 1998	Oct 1998	Dec 1998	Mar 1999	June 1999	Sept 1999	Dec 1999	Mar 2000	June 2000	Sept 2000	Mar 2001
S-1	---	---	---	---	---	---	---	---	---	---	---	---
S-2	A	A	A	A	A	A	A	A	A	A	A	A
S-3 / S-3R	0.198	0.070	---	---	0.031	---	0.618	0.082	0.108	---	0.162	0.306
S-4	0.017	DUP 0.215	---	---	0.031	---	0.050	---	0.080	---	0.060	0.135
S-5 / S-5R	< 0.004	0.089	---	---	0.008	---	< 0.004	---	0.011	---	0.075	0.369
S-6	0.127	**5.900**	---	0.735	DUP 1.450	0.419	0.451	0.553	0.914	0.176	0.790	0.791
S-8	---	---	---	---	---	---	---	---	---	---	---	---
S-84-1	A	A	A	A	A	A	A	A	A	A	A	A
S-84-3	A	A	A	A	A	A	A	A	A	A	A	A
S-84-4	---	---	---	---	---	---	---	---	---	---	---	---
S-84-5	---	---	---	---	---	---	---	---	---	---	---	---
S-84-6	---	---	---	---	---	---	---	---	---	---	---	---
S-84-9	< 0.004	**5.900**	0.283	0.735	1.450	0.419	---	---	---	---	---	---
S-84-10	0.074	0.123	---	---	0.069	---	0.147	---	0.051	---	0.133	0.014
S-84-11	0.019	0.037	---	---	0.008	---	0.017	---	0.022	---	0.058	0.091
S-84-14	---	---	---	---	---	---	---	---	---	---	---	---
S-84-15	---	---	0.012	0.012	0.010	0.007	0.046	0.017	0.011	0.026	---	---
S-84-16	---	---	DUP 0.021	DUP 0.013	0.020	0.012	0.019	0.088	0.010	0.015	0.007	0.010
S-85-1b	A	A	A	A	A	A	A	A	A	A	A	A
S-85-2	---	---	---	---	---	---	---	---	---	---	---	---
S-85-3	0.278	0.157	---	---	0.330	---	0.120	---	DUP 0.290	---	DUP 4.960	0.965
S-85-4a	A	A	A	A	A	A	A	A	A	A	A	A
S-85-4b	A	A	A	A	A	A	A	A	A	A	A	A
S-85-4c	A	A	A	A	A	A	A	A	A	A	A	A
S-85-5a	1.010	1.800	---	1.310	0.698	1.060	DUP 1.580	1.120	0.981	0.623	1.000	0.483
S-85-5b	0.808	---	2.000	1.330	**6.460**	2.920	3.290	1.590	0.737	1.870	1.800	DUP 0.685
S-85-6a	---	---	3.360	2.610	2.690	2.290	**33.500**	0.765	1.230	0.738	1.020	0.643
S-85-6b	---	---	**28.000**	**29.500**	**29.000**	**22.100**	2.230	DUP **33.300**	DUP **29.200**	DUP **21.200**	DUP **30.100**	DUP **28.700**
S-85-7	1.210	4.220	---	---	< 0.004	---	**11.200**	---	**5.670**	---	4.140	3.300
S-85-8a	**10.100**	**11.100**	---	---	**5.670**	---	**20.700**	---	**8.730**	---	**5.710**	**51.500**
S-85-8b	DUP 0.808	DUP 4.470	---	---	DUP 1.140	---	DUP 3.220	---	DUP 4.000	---	DUP 4.490	DUP 4.450
S-86-1	---	---	---	---	---	---	---	---	---	---	---	---
S-88-1	0.251	0.021	---	---	0.022	---	0.064	0.069	< 0.006	---	< 0.006	0.067
S-88-2	0.045	0.083	---	0.134	0.039	0.255	0.106	0.015	0.045	0.034	0.016	0.402
S-88-3	0.180	0.019	---	0.079	0.066	0.007	0.021	0.068	0.028	0.060	0.185	0.092
S-91-1	< 0.004	0.013	---	---	0.005	---	0.010	---	0.134	---	0.009	0.047
S-91-2	---	---	---	---	---	---	---	---	---	---	0.041	---
S-91-3	0.004	0.006	---	---	< 0.004	---	0.007	---	0.007	---	0.009	0.006
S-91-4	DUP 0.004	DUP 0.006	---	---	DUP 0.005	---	DUP 0.009	---	DUP 0.016	---	DUP 0.010	DUP 0.043
S-93-2D	---	---	---	1.540	0.095	0.390	0.238	---	---	---	---	---
S-93-2S	---	---	---	0.170	0.139	0.041	0.030	---	---	---	---	---
S-93-7	DUP 0.007	DUP 0.115	0.026	---	0.009	---	0.021	---	DUP 0.030	---	DUP 0.089	0.038
S-95-1	DUP 0.011	0.176	0.107	---	DUP 0.012	---	DUP 0.006	---	0.025	---	0.019	DUP 0.010
SP-11 / SP-10	0.109	0.037	0.269	---	0.152	---	0.055	---	0.058	---	0.029	0.021
TW-1	---	---	0.044	---	0.087	---	0.034	---	0.062	---	0.614	0.118
TW-2	---	---	---	---	---	---	---	---	---	---	---	---
Swamp Pond	0.005	0.017	0.009	---	0.007	---	0.012	---	0.119	---	< 0.006	---

A = Abandoned.
--- = not sampled.
DUP = duplicate sample taken, highest concentration reported
* = S-5 replaced by S-5R during Summer 1993, SP-10 replaced SP-11 during Fall 1996, and S-3R replaced S-3 during Fall 1999.
Target cleanup level = 5 mg/L

f:\projects\1860\250CGAPermit\revised\tab2-zinc

Table 3
Summary Analytical Data
Well S-91-2
BNSF - Somers, MT

Sample Location: / Collection Date:	S-91-2 04/17/00	S-91-2 09/03/00	S-91-2 11/29/2000	S-91-2 03/21/01	WQB-7 Level
SVOC 8270 (ug/L)					
Phenol	< 2.0	**2.5**	< 2.0	< 2.0	300
Bis-(2-Chloroethyl) Ether	< 2.0	< 2.0	< 2.0	< 2.0	--
2-Chlorophenol	< 1.0	< 1.0	< 1.0	< 1.0	--
1,3-Dichlorobenzene	< 1.0	< 1.0	< 1.0	< 1.0	--
1,4-Dichlorobenzene	UJ <1.0	< 1.0	< 1.0	< 1.0	--
Benzyl Alcohol	< 5.0	< 5.0	< 5.0	< 5.0	--
1,2-Dichlorobenzene	< 1.0	< 1.0	< 1.0	< 1.0	--
2-Methylphenol	**4.0**	< 2.0	**2.7**	< 1.0	--
2,2'-Oxybis(1-Chloropropane)	< 1.0	< 1.0	< 1.0	< 1.0	--
4-Methylphenol	**3.4**	**32**	**3.6**	< 1.0	--
N-Nitroso-Di-N-Propylamine	UJ <2.0	< 2.0	< 2.0	< 2.0	--
Hexachloroethane	< 2.0	< 2.0	< 2.0	< 2.0	--
Nitrobenzene	< 1.0	< 1.0	< 1.0	< 1.0	--
Isophorone	< 1.0	< 1.0	< 1.0	< 1.0	--
2-Nitrophenol	< 5.0	< 5.0	< 5.0	< 5.0	--
2,4-Dimethylphenol	D **3,800**	D **3,600**	D **2,200**	D **3,000**	--
Benzoic Acid	< 10	< 10	< 10	< 10	--
bis(2-Chloroethoxy) Methane	< 1.0	< 1.0	< 1.0	< 1.0	--
2,4-Dichlorophenol	< 3.0	< 3.0	< 3.0	< 3.0	--
1,2,4-Trichlorobenzene	UJ <1.0	< 1.0	< 1.0	< 1.0	--
Naphthalene	**3.3**	**4.0**	**2.1**	**2.0**	28
4-Chloroaniline	< 3.0	< 3.0	< 3.0	< 3.0	--
Hexachlorobutadiene	< 2.0	< 2.0	< 2.0	< 2.0	--
4-Chloro-3-methylphenol	< 2.0	< 2.0	< 2.0	< 2.0	--
2-Methylnaphthalene	1.4	< 1.0	< 1.0	< 1.0	--
Hexachlorocyclopentadiene	< 5.0	< 5.0	< 5.0	< 5.0	--
2,4,6-Trichlorophenol	< 5.0	< 5.0	< 5.0	< 5.0	--
2,4,5-Trichlorophenol	< 5.0	< 5.0	< 5.0	< 5.0	--
2-Chloronaphthalene	< 1.0	< 1.0	< 1.0	< 1.0	--
2-Nitroaniline	< 5.0	< 5.0	< 5.0	< 5.0	--
Dimethylphthalate	< 1.0	< 1.0	< 1.0	< 1.0	--
Acenaphthylene	< 1.0	< 1.0	< 1.0	< 1.0	--
3-Nitroaniline	< 6.0	< 6.0	< 6.0	< 6.0	--
Acenaphthene	UJ <1.0	< 1.0	< 1.0	< 1.0	--
2,4-Dinitrophenol	< 10	< 10	< 10	< 10	--
4-Nitrophenol	< 5.0	< 5.0	< 5.0	< 5.0	--
Dibenzofuran	< 1.0	< 1.0	< 1.0	< 1.0	--
2,6-Dinitrotoluene	< 5.0	< 5.0	< 5.0	< 5.0	--
2,4-Dinitrotoluene	UJ <1.0	< 5.0	< 5.0	< 5.0	--
Diethylphthalate	< 1.0	< 1.0	< 1.0	< 1.0	--
4-Chlorophenyl-phenylether	< 1.0	< 1.0	< 1.0	< 1.0	--
Fluorene	< 1.0	< 1.0	< 1.0	< 1.0	--
N-Nitrosodiphenylamine	< 1.0	< 1.0	< 1.0	< 1.0	--
4-Nitroaniline	< 5.0	< 5.0	< 5.0	< 5.0	--
4,6-Dinitro-2-Methylphenol	< 10	< 10	< 10	< 10	--
N-Nitrosodiphenylamine	< 1.0	< 1.0	< 1.0	< 1.0	--
4-Bromophenyl-phenylether	< 1.0	< 1.0	< 1.0	< 1.0	--
Hexachlorobenzene	< 5.0	< 1.0	< 5.0	< 5.0	--
Pentachlorophenol	< 1.0	< 5.0	< 1.0	< 1.0	--
Phenanthrene	< 1.0	< 1.0	< 1.0	< 1.0	--
Carbazole	< 1.0	< 1.0	< 1.0	< 1.0	--
Anthracene	< 1.0	< 1.0	< 1.0	< 1.0	--
Di-n-Butylphthalate	< 1.0	< 1.0	< 1.0	< 1.0	--
Fluoranthene	UJ <1.0	< 1.0	< 1.0	< 1.0	--
Pyrene	< 1.0	< 1.0	< 1.0	< 1.0	--
Butylbenzylphthalate	< 5.0	< 1.0	< 5.0	< 5.0	--
3,3'-Dichlorobenzidine	< 1.0	< 5.0	< 1.0	< 1.0	--
Benzo(a)anthracene	< 1.0	< 1.0	< 1.0	< 1.0	--
bis(2-Ethylhexyl)phthalate	< 1.0	< 1.0	< 1.0	< 1.0	--
Chrysene	< 1.0	< 1.0	< 1.0	< 1.0	--
Di-n-Octyl phthalate	< 1.0	< 1.0	< 1.0	< 1.0	--
Benzo(b)fluoranthene	< 1.0	< 1.0	< 1.0	< 1.0	--
Benzo(k)fluoranthene	< 1.0	< 1.0	< 1.0	< 1.0	--
Benzo(a)pyrene	< 1.0	< 1.0	< 1.0	< 1.0	--
Indeno(1,2,3-cd)pyrene	< 1.0	< 1.0	< 1.0	< 1.0	--
Dibenzo(a,h)anthracene	< 1.0	< 1.0	< 1.0	< 1.0	--
Benzo(g,h,i)perylene	< 1.0	< 1.0	< 1.0	< 1.0	--
Total PAH (ug/L)	3.3	4.0	2.1	2.0	--

Attachment 2: Summary of Capture Zone Analysis

A capture zone analysis was conducted by placing hypothetical wells at various upgradient, downgradient, and cross-gradient property boundary locations. The modeling simulated various pumping rates and determined the potential groundwater flow path and travel time for each location. The resulting capture zone was evaluated to determine if it overlapped the area of impacted groundwater at the Somers Tie Plant.

The capture zone analysis was conducted using site-specific aquifer parameters and the groundwater flow program, MODFLOW. An existing model for the site was used as the starting basis model for the simulations. Since the locations of the hypothetical wells were near the boundaries of the existing model, the model was extended horizontally to minimize boundary effects on pumping wells. Additionally, the existing model only included the top 60 feet of alluvium; since bedrock wells were a possibility in the area, an additional 30 feet of alluvium, a 10 foot transition zone between the bedrock and alluvium layers and a 500 foot bedrock layer were added to the model. The bedrock hydraulic conductivity data determined by a pump test from the Somers Town well was used and no further calibration was conducted with the model after the addition, due to the intended screening nature of the simulations.

The model grid and boundary conditions provided adequate detail and included enough clearance around the hypothetical wells such that boundary effects were not significant. The grids in the model were 10 by 10 feet and increased to 170 by 170 feet at the boundaries. The total model size was 2500 by 2700 feet. The up and downgradient conditions were specified as constant heads, including Flathead Lake, and were given groundwater elevations to achieve the site-specific groundwater gradient. Figure 1 shows the model domain.

An aquifer saturated thickness of 90 feet in the alluvium, a 10 foot transition zone, and a 500 foot bedrock thickness were used based on site investigations, reports, and drilling logs. Based on pump tests, the hydraulic conductivity values ranged from a high of 44 ft/day in the bedrock, 10 ft/day in the transition zone, to a low of 0.99 ft/day in the alluvium. With the above parameters as input to the model, several different well pumping rates were simulated in a steady-state analysis. The MODPATH particle-tracking model was used to define the groundwater flow path, travel time and the resulting capture zone for each hypothetical well.

The results of the hypothetical wells placed in the alluvium are shown in Figures 2 through 7. The wells are pumping at 1 gpm, since actual pumping tests for site wells fully screened within the alluvium show that is approximately the maximum rate possible. A model sensitivity simulation was conducted to determine what maximum theoretical flow rate was possible from each model well. The maximum theoretical rates were shown to range from 7.5 to 11 gpm. These rates are an artifact of the model, and are the result of a 6-inch diameter well being represented in the model by a 10 by 10 ft grid. The capture zone figures for the 1 gpm pumping rates illustrate both the predicted groundwater elevation contours and the groundwater flow paths. Each arrow on the flow path represents an interval of 10 years travel time for a particle of groundwater along that flow path.

The hypothetical House Block well in the alluvium is predicted to capture groundwater to some degree from the impacted area; however, the time required is on the order of tens to hundreds of years. This means pumping from the alluvial aquifer at a constant rate of 1 gpm, groundwater from the impacted area could eventually be drawn into the well after a minimum of ten years of continuous pumping. Additionally, the flow time represents a groundwater particle, whereas the transport time for the PAHs dissolved in the groundwater would generally be greatly retarded in comparison.

The results of the hypothetical wells placed in the bedrock are shown in Figures 8 through 17. The wells are pumping at 100 and 500 gpm, since pumping tests at the Somers town well for wells fully screened within the alluvium show that these rates are possible. The different particle flow path colors represent flow through the different layers: bedrock (yellow), the transition zone (blue) and the alluvium (red). The results illustrated in the figures show that at 100 gpm, there was no groundwater capture from area of impacted alluvium. At 500 gpm, the hypothetical House Block, North, and South Wells could eventually capture some alluvium groundwater from impacted area. This means pumping from the bedrock aquifer at a constant rate of 500 gpm, groundwater from the alluvial aquifer could eventually be drawn into the bedrock aquifer after a minimum of ten years of continuous pumping. However, as discussed above, the flow time represents a groundwater particle, whereas the transport time for any PAHs dissolved in the groundwater would generally be greatly retarded in comparison.

Model Layers

		Ground Surface
90 ft	K=0.2 to 0.8 ft/day	Alluvium
10 ft	K=10 ft/day	Transition Zone
500 ft	K=44 ft/day	Bedrock

Alluvium Model Assumptions

- Well pumping rate is 1 gpm
- Each simulation conducted independently (i.e. only 1 well pumping per simulation)
- Model used is calibrated alluvium model with 10 ft transition zone and bedrock added (alluvium is 90 ft thick)
- Simulations are steady state flow conditions

Bedrock Model Assumptions

- Well pumping rates are 100 and 500 gpm from Bedrock
- Each simulation conducted independently (i.e. only 1 well per simulation)
- Model used is calibrated alluvium model with transition zone and bedrock added
- Simulations are steady state flow conditions
- Bedrock wells were fully screened

Figure Legend

•Particle Flow Path colors represent different layers:

Yellow = Bedrock

Blue = Transition Zone

Red = Alluvium

•Arrow Interval is 10 years

•Particles were run in reverse with starting zone at very top of bedrock to determine likely worst case capture from Alluvium

Summary of Bedrock Results

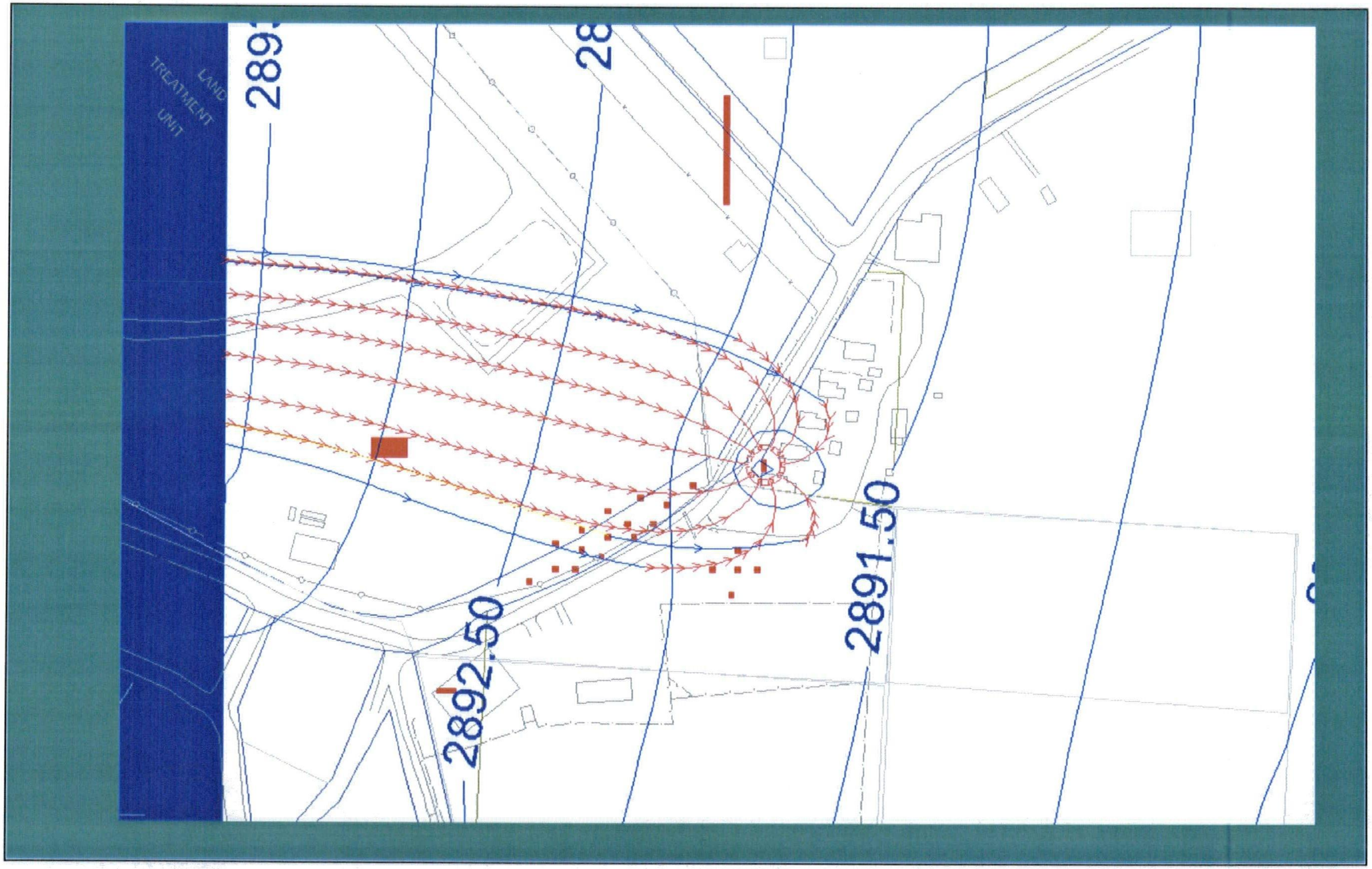
- At 100 gpm, no GW capture from area of impacted Alluvium is indicated
- At 500 gpm, House Block, North, and South Wells would eventually capture some Alluvium GW from Impacted area

Figure 1
Model Domain

LEGEND

Black Area – No flow
Blue Area – Constant Head
Lt. Blue Area – General Head Boundary
Red Areas – Alluvial Wells

Figure 2
1 gpm Well in North Homesites – Alluvium Well

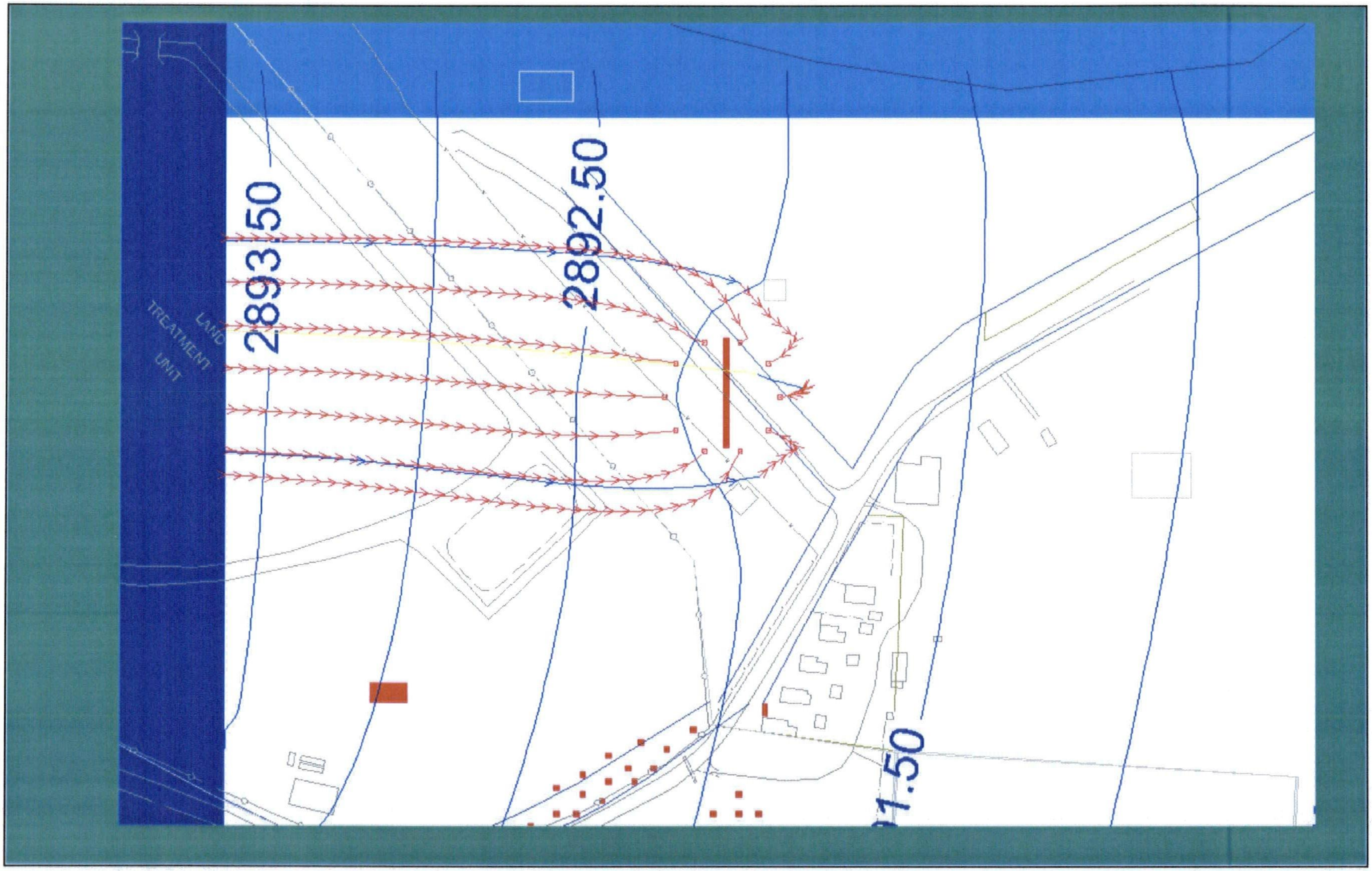


Note: Arrowhead interval equals 10 year travel time for groundwater along flowpath, contour interval 0.5 ft

Figure 3
1 gpm Well on Southwest Boundary – Alluvium Well

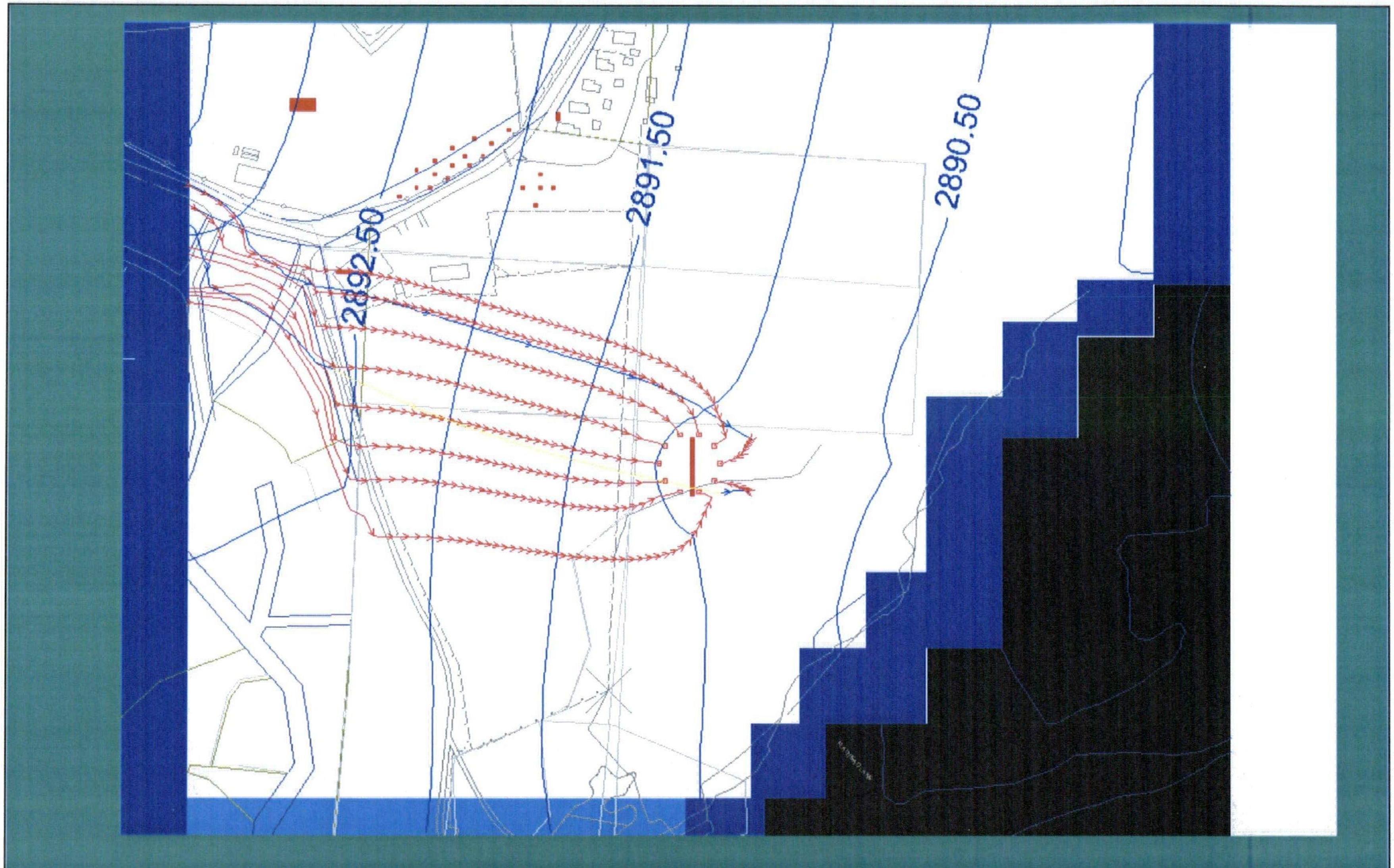
Note: Arrowhead interval equals 10 year travel time for groundwater along flowpath, contour interval 0.5 ft

Figure 4
1 gpm Well on North Boundary – Alluvium Well



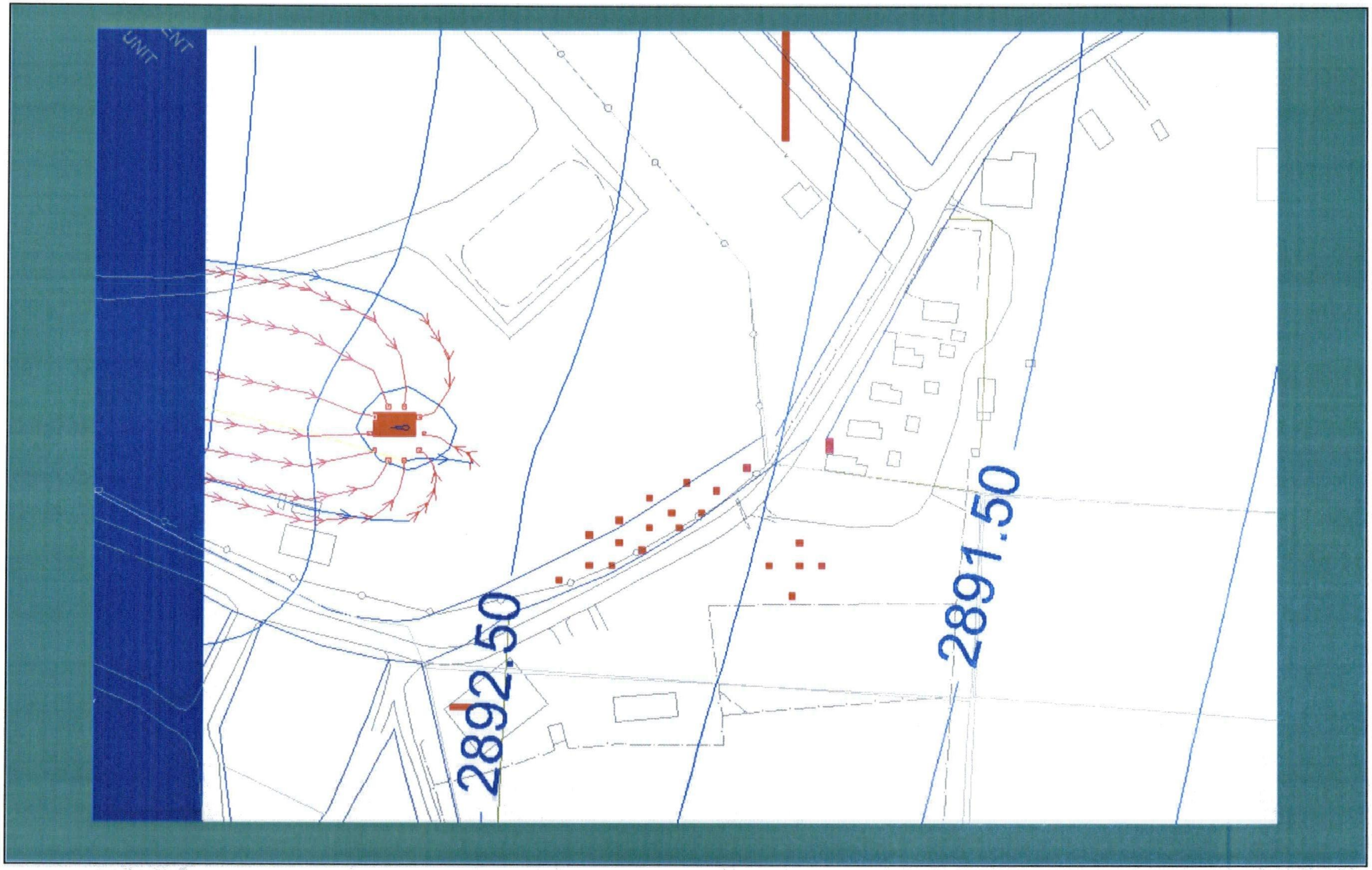
Note: Arrowhead interval equals 10 year travel time for groundwater along flowpath, contour interval 0.5 ft

Figure 5
1 gpm Well on South Boundary – Alluvium Well



Note: Arrowhead interval equals 10 year travel time for groundwater along flowpath, contour interval 0.5 ft

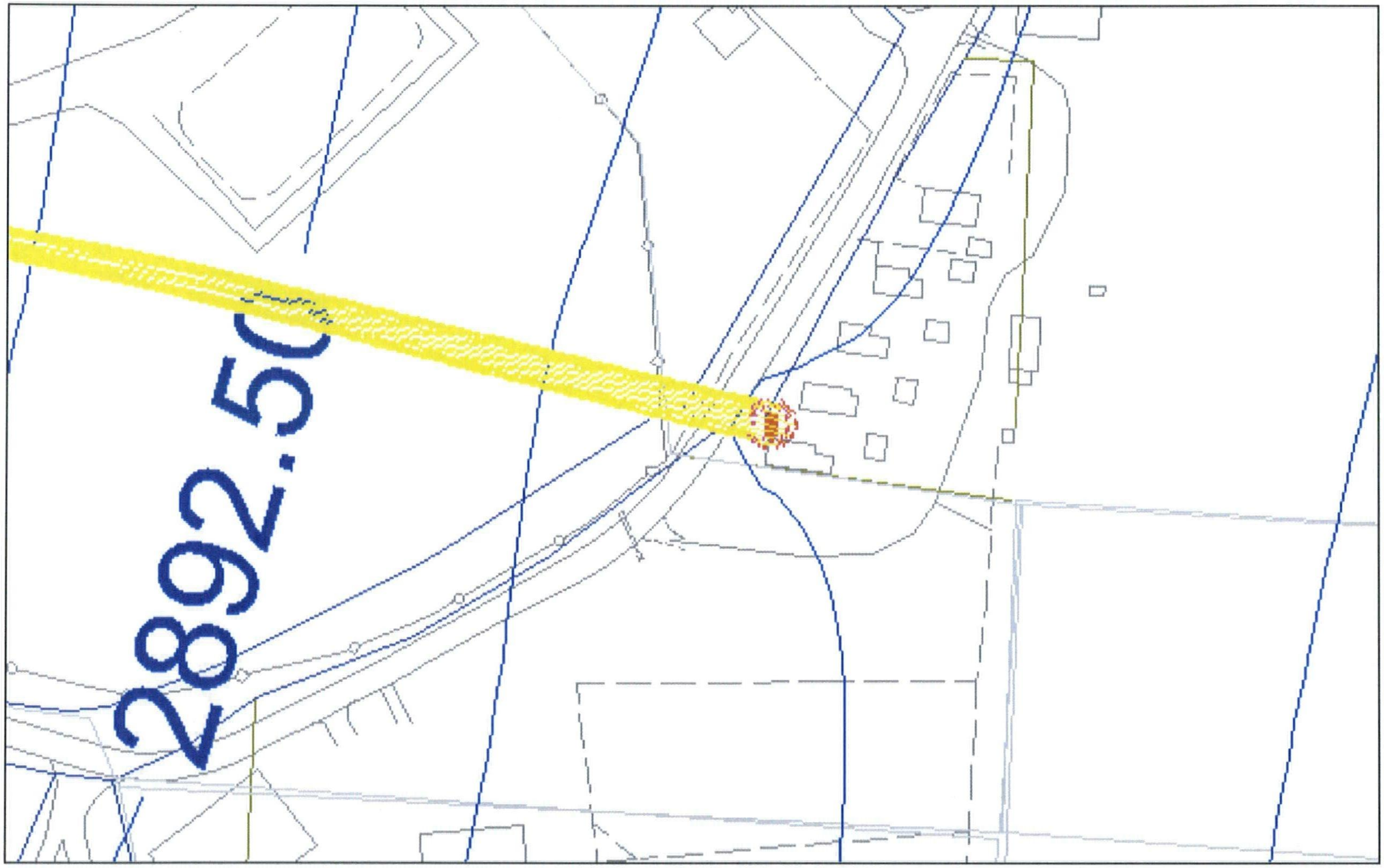
Figure 6
1 gpm Well On site – Alluvium Well



Note: Arrowhead interval equals 10 year travel time for groundwater along flowpath, contour interval 0.5 ft

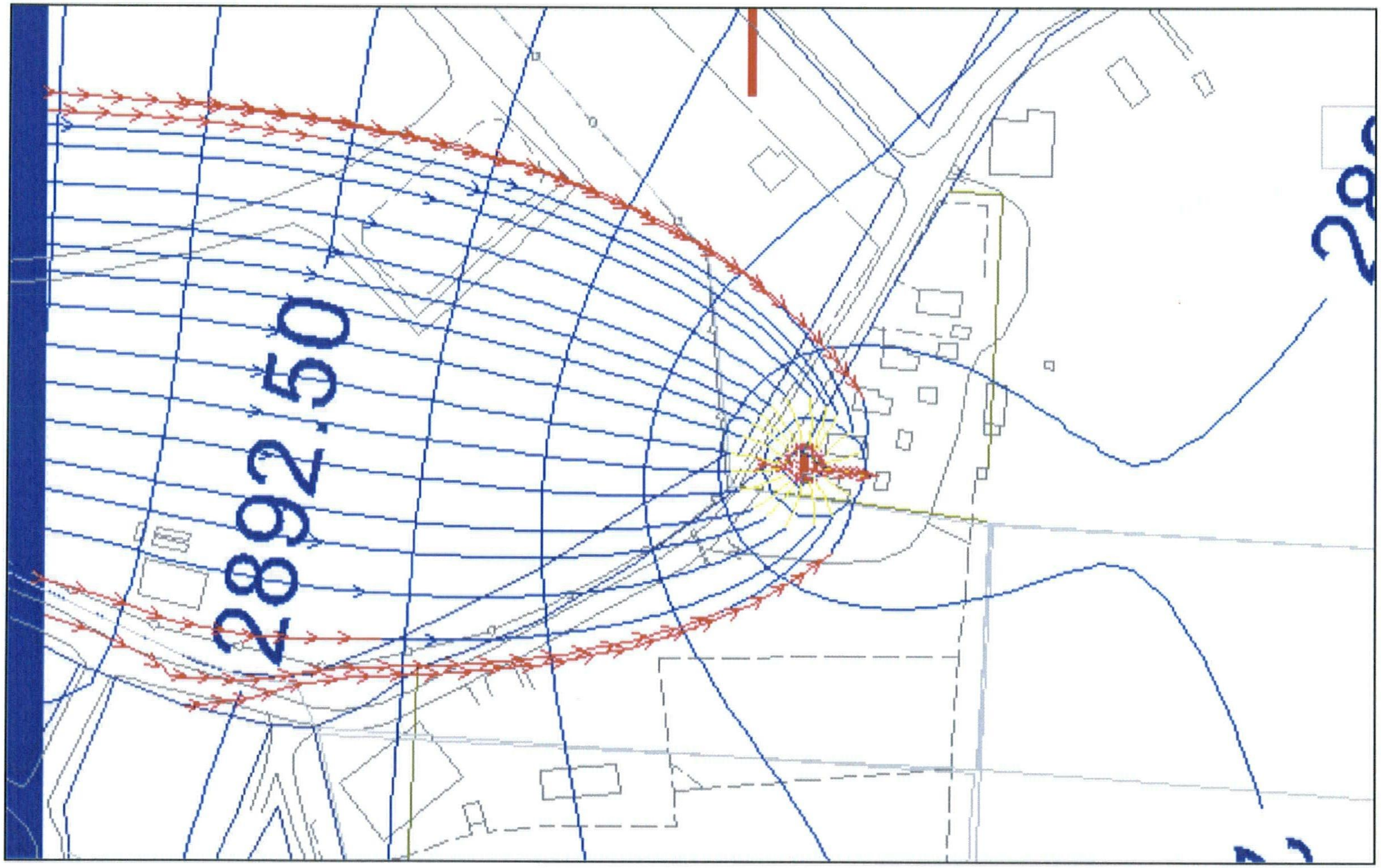
Figure 7

Bedrock House Block Well @ 100 gpm



Note: Arrowhead interval equals 10 year travel time for groundwater along flowpath, contour interval 0.5 ft

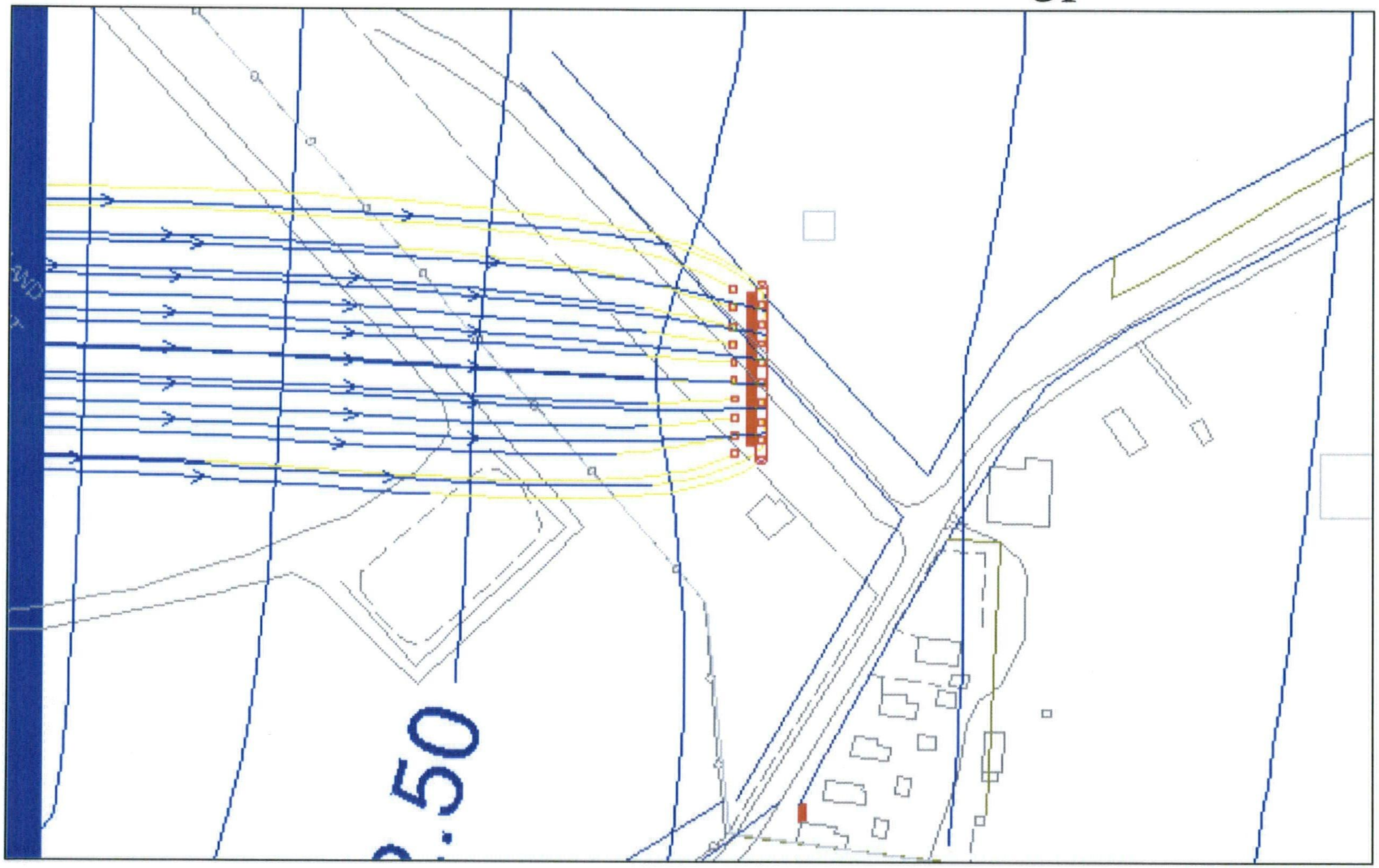
Figure 8
Bedrock House Block Well @ 500 gpm



Note: Arrowhead interval equals 10 year travel time for groundwater along flowpath, contour interval 0.5 ft

Figure 9

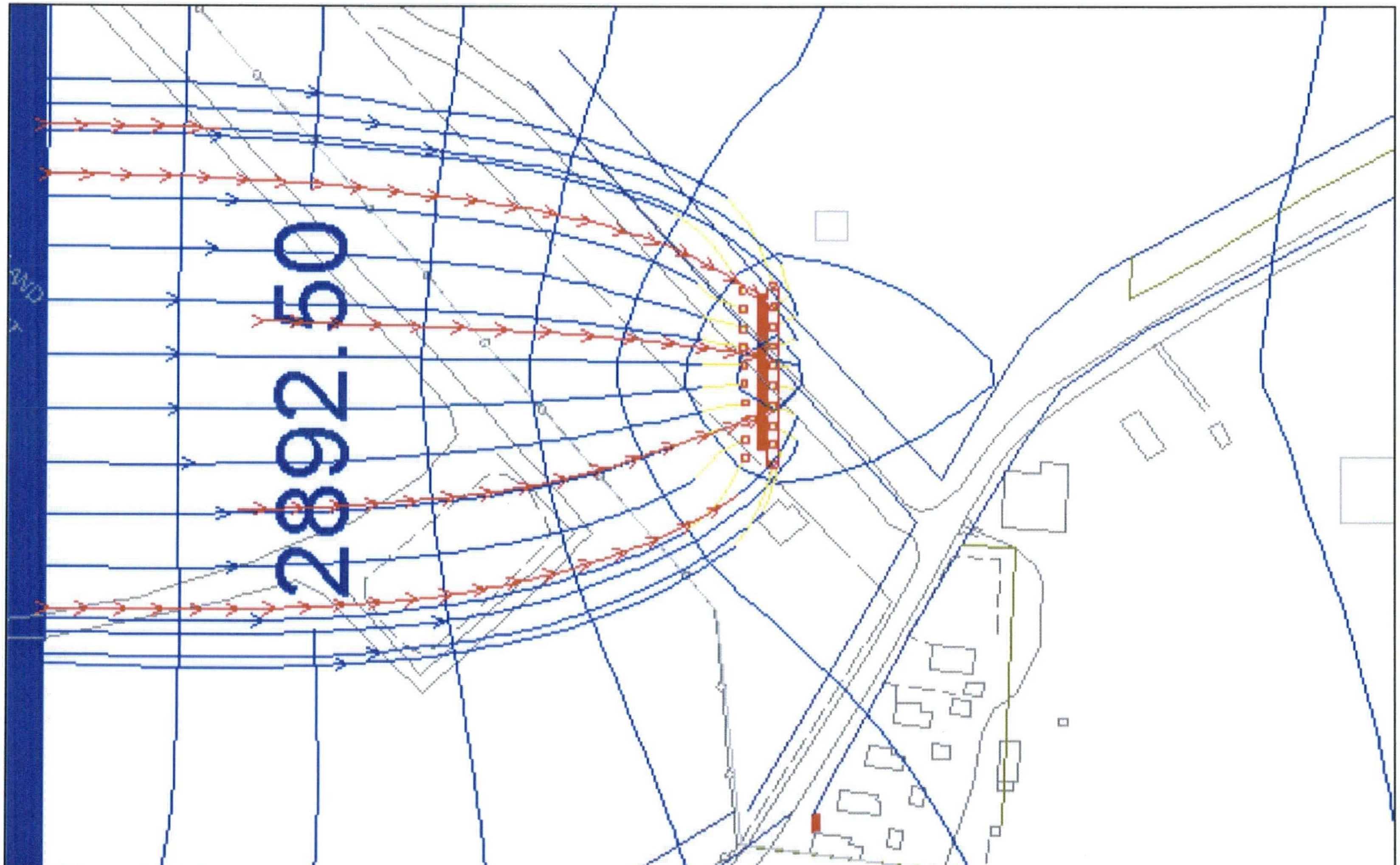
Bedrock North Well @ 100 gpm



Note: Arrowhead interval equals 10 year travel time for groundwater along flowpath, contour interval 0.5 ft

Figure 10

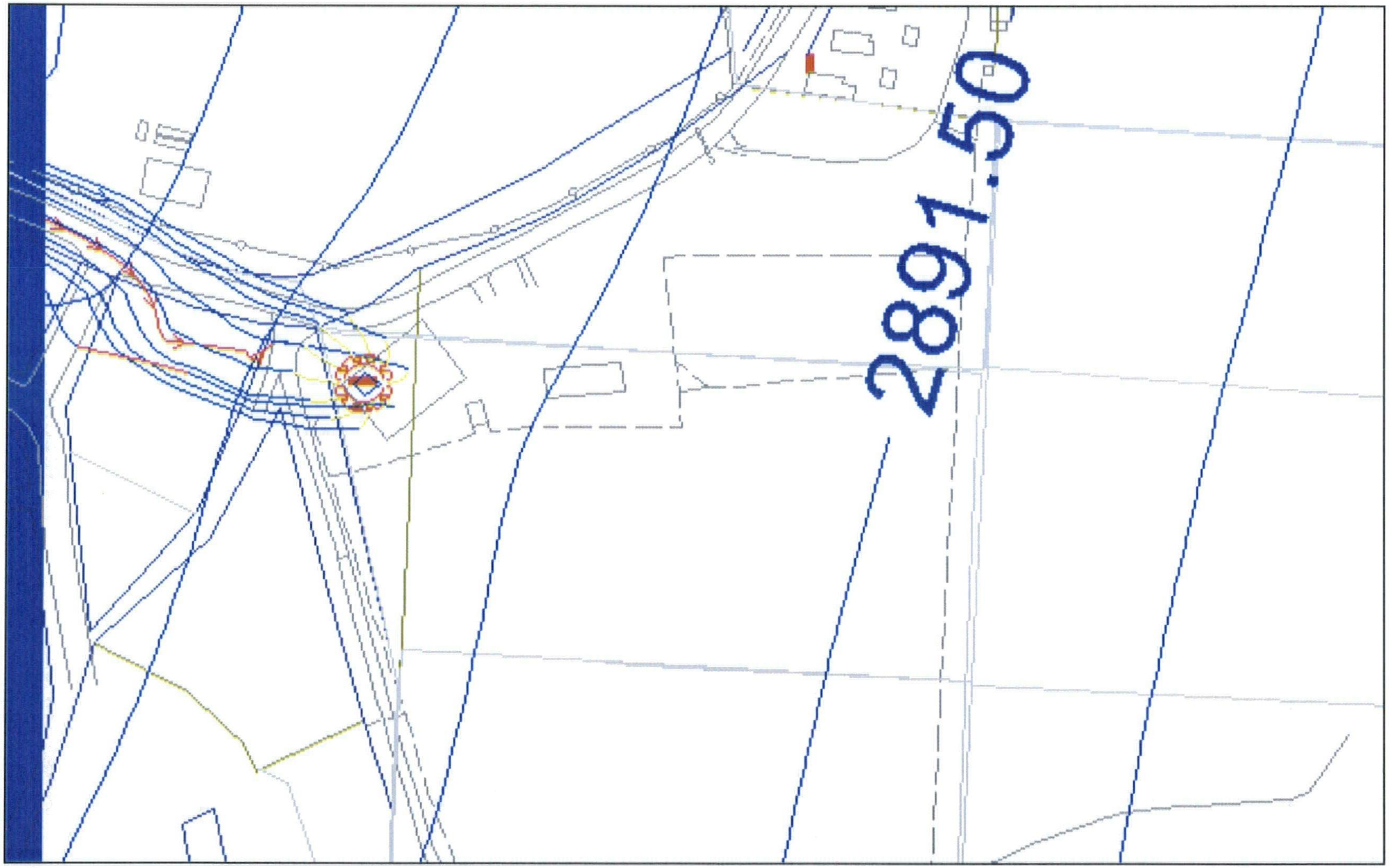
Bedrock North Well @ 500 gpm



Note: Arrowhead interval equals 10 year travel time for groundwater along flowpath, contour interval 0.5 ft

Figure 11

Bedrock West Well @ 100 gpm



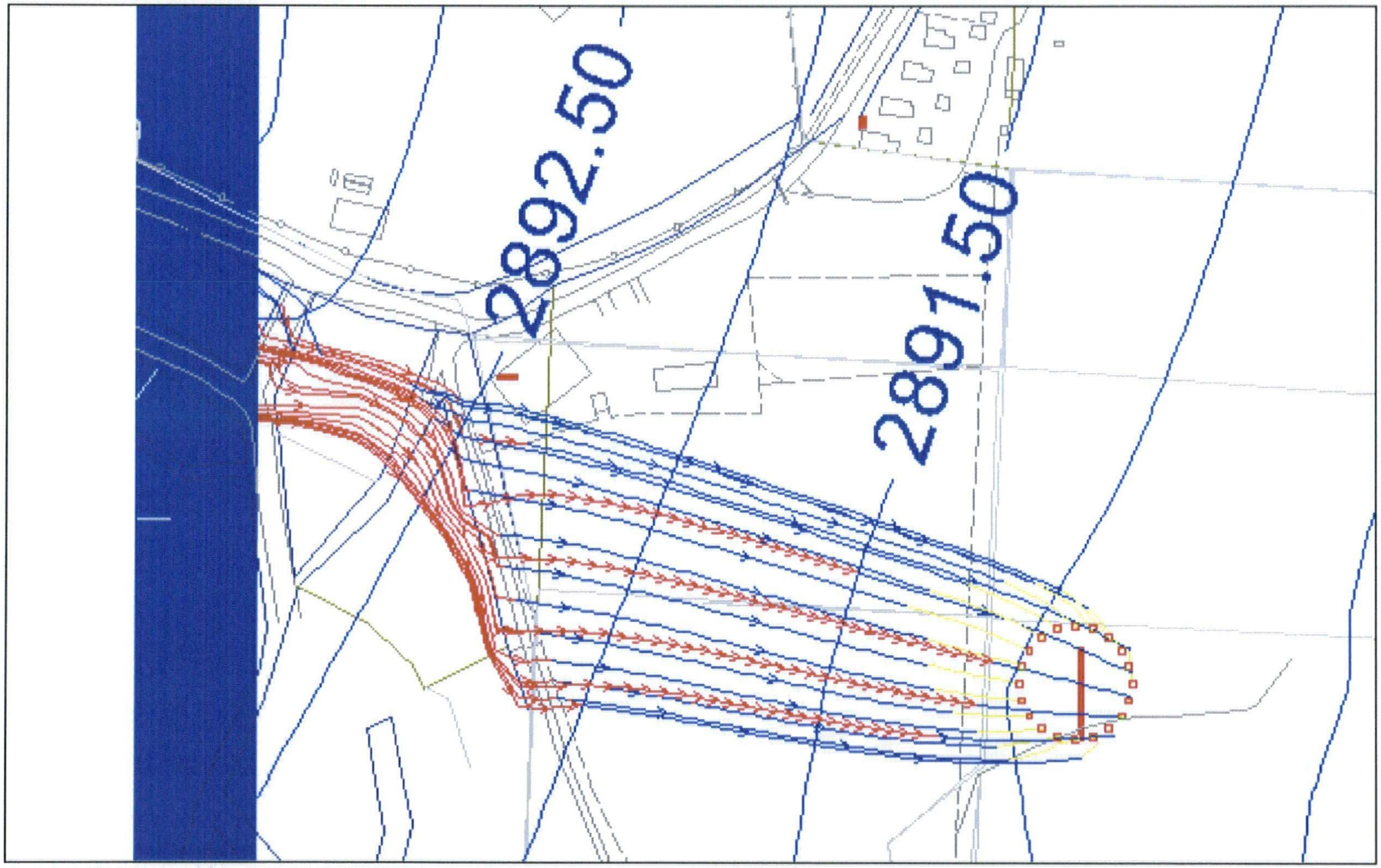
Note: Arrowhead interval equals 10 year travel time for groundwater along flowpath, contour interval 0.5 ft

Figure 12
Bedrock West Well @ 500 gpm

Note: Arrowhead interval equals 10 year travel time for groundwater along flowpath, contour interval 0.5 ft

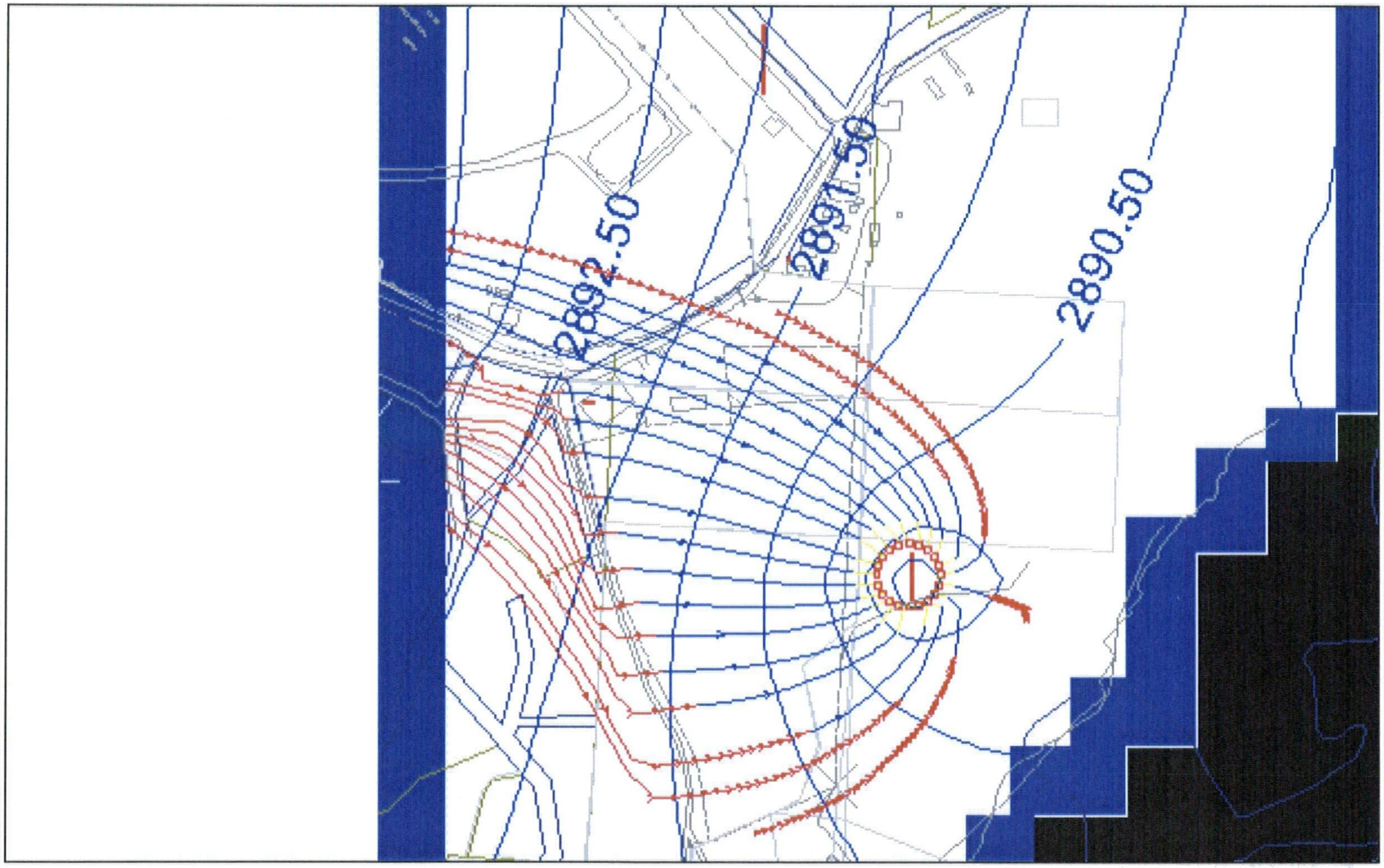
Figure 13

Bedrock South Well @ 100 gpm



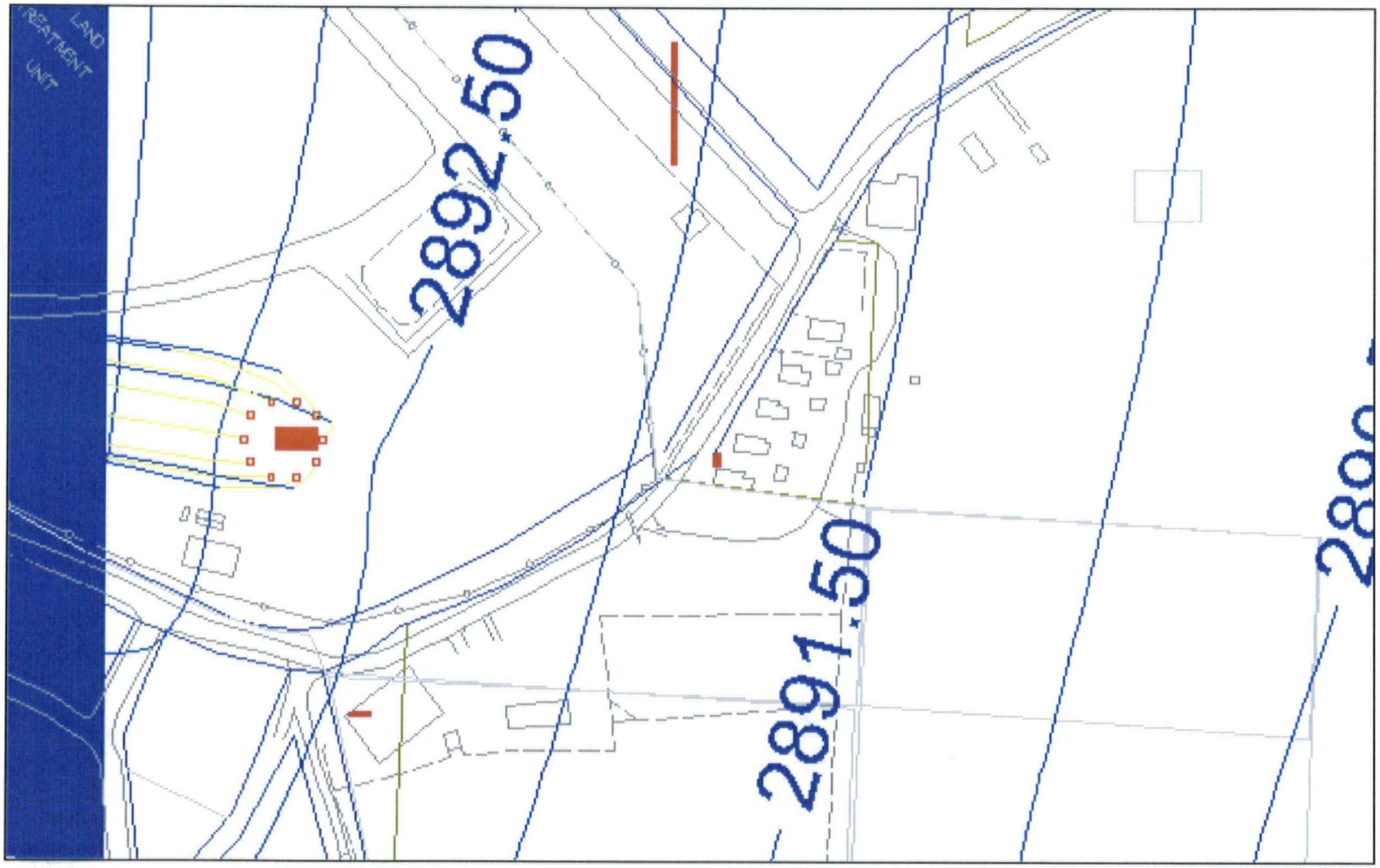
Note: Arrowhead interval equals 10 year travel time for groundwater along flowpath, contour interval 0.5 ft

Figure 14
Bedrock South Well @ 500 gpm



Note: Arrowhead interval equals 10 year travel time for groundwater along flowpath, contour interval 0.5 ft

Figure 15
Bedrock Well On Site @ 100 gpm

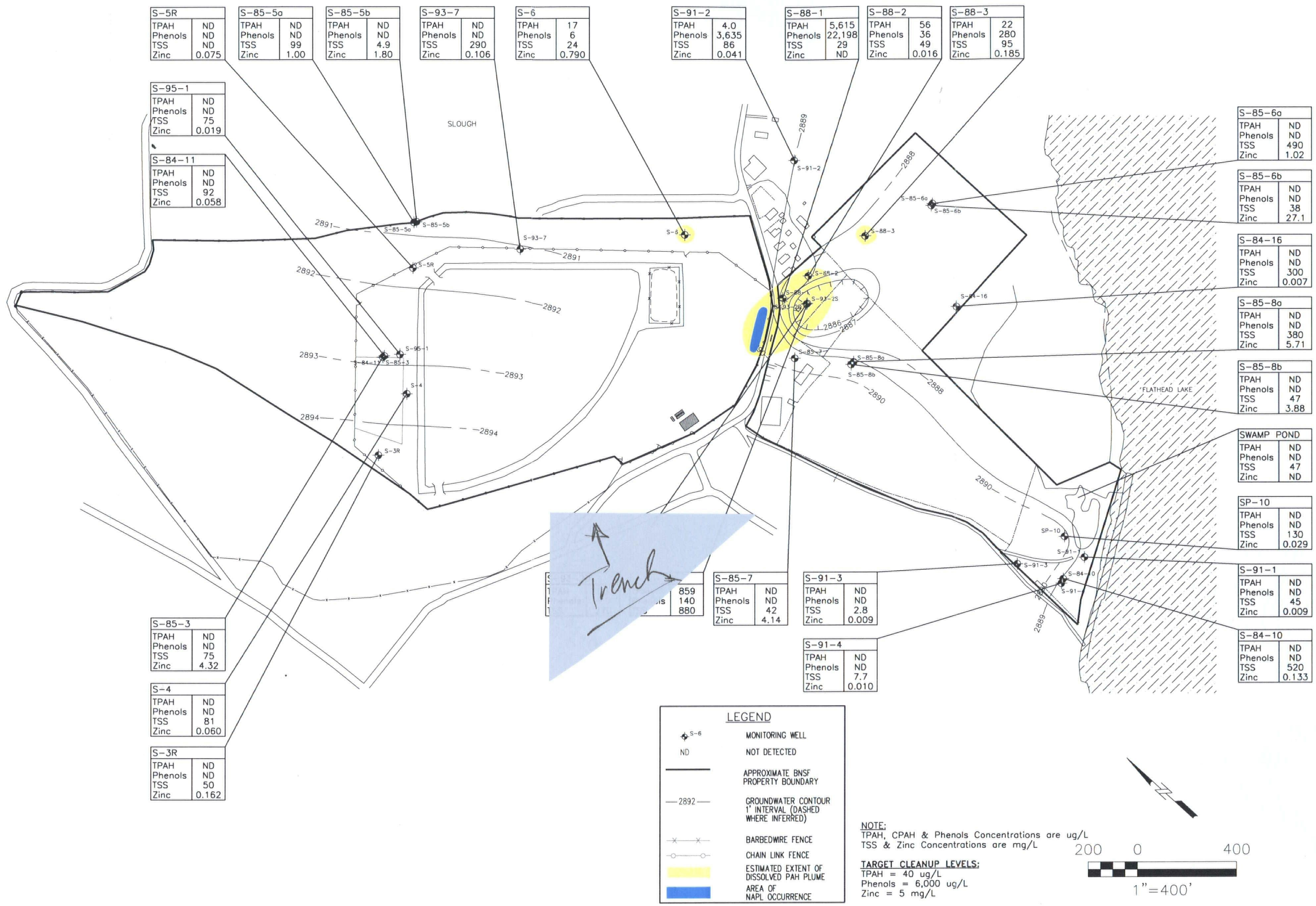


Note: Arrowhead interval equals 10 year travel time for groundwater along flowpath, contour interval 0.5 ft

Figure 16

Bedrock Well On Site @ 500 gpm

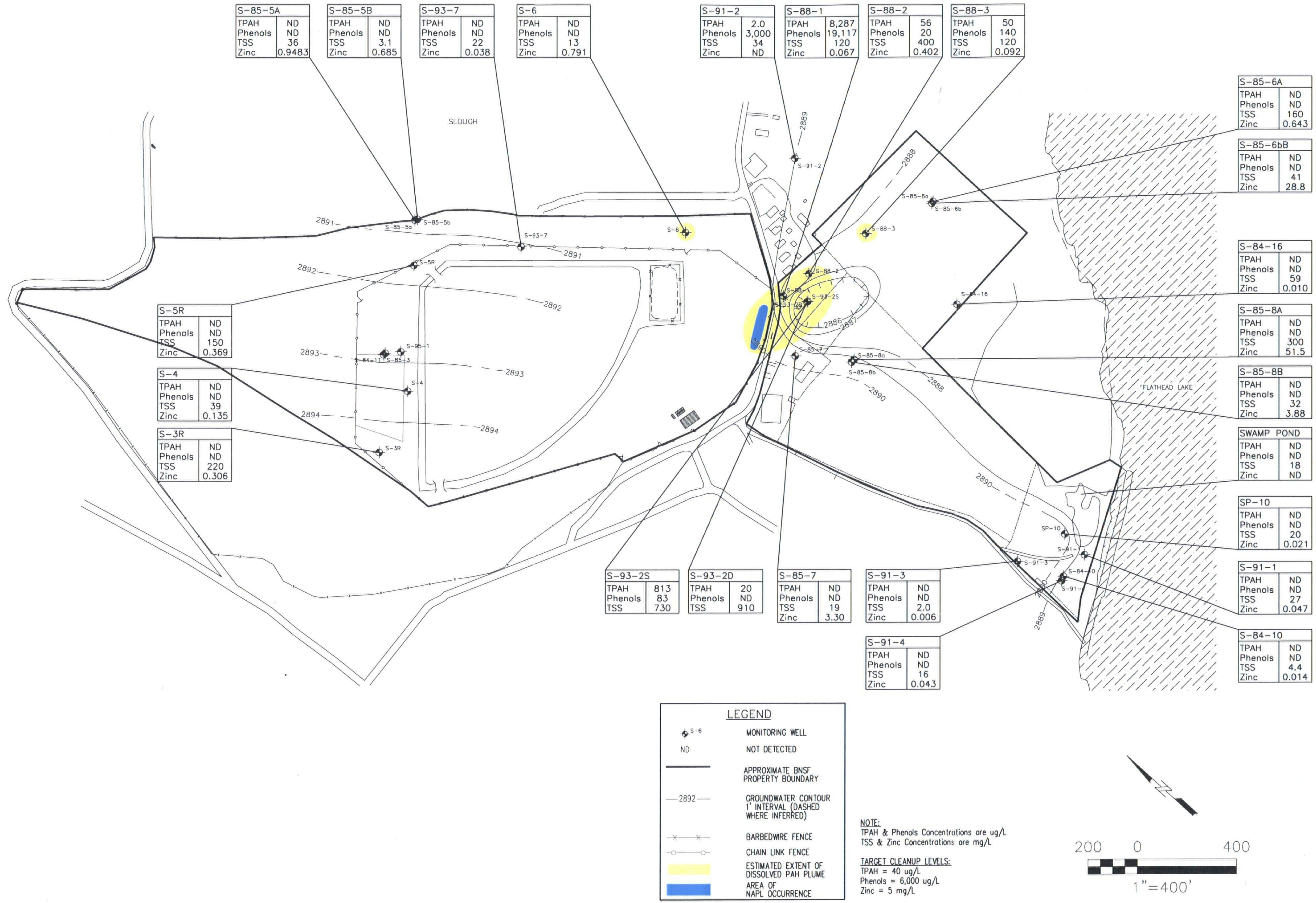
Note: Arrowhead interval equals 10 year travel time for groundwater along flowpath, contour interval 0.5 ft



ThermoRetec

BNSF

CONTROLLED GROUNDWATER USE AREA PETITION BN080-01860-250	SITEWIDE TPAH, PHENOL, TSS AND ZINC CONCENTRATIONS SEPTEMBER 2000 BNSF - SOMERS, MT
CURRENT DATE 9/12/01 CADD FILE Fig5	FIGURE 5



ThermoRetec

BNSF

CONTROLLED GROUNDWATER USE AREA PETITION	SITEWIDE TPAH, PHENOL, TSS AND ZINC CONCENTRATIONS MARCH 2001 BNSF - SOMERS, MT
BN080-01860-250	
CURRENT DATE 11/21/01 — CADD FILE Fig6	FIGURE 6

ThermoRetec

BNSF

CONTROLLED GROUNDWATER USE AREA PETITION BN080-01860-250				PROPOSED BOUNDARY AREA BNSF - SOMERS, MT
CURRENT DATE	9/05/01	CADD FILE	NewFig7	FIGURE 7

LEGEND

BNSF PROPERTY BOUNDARY

TOWN WELL LOCATION

150 0 300

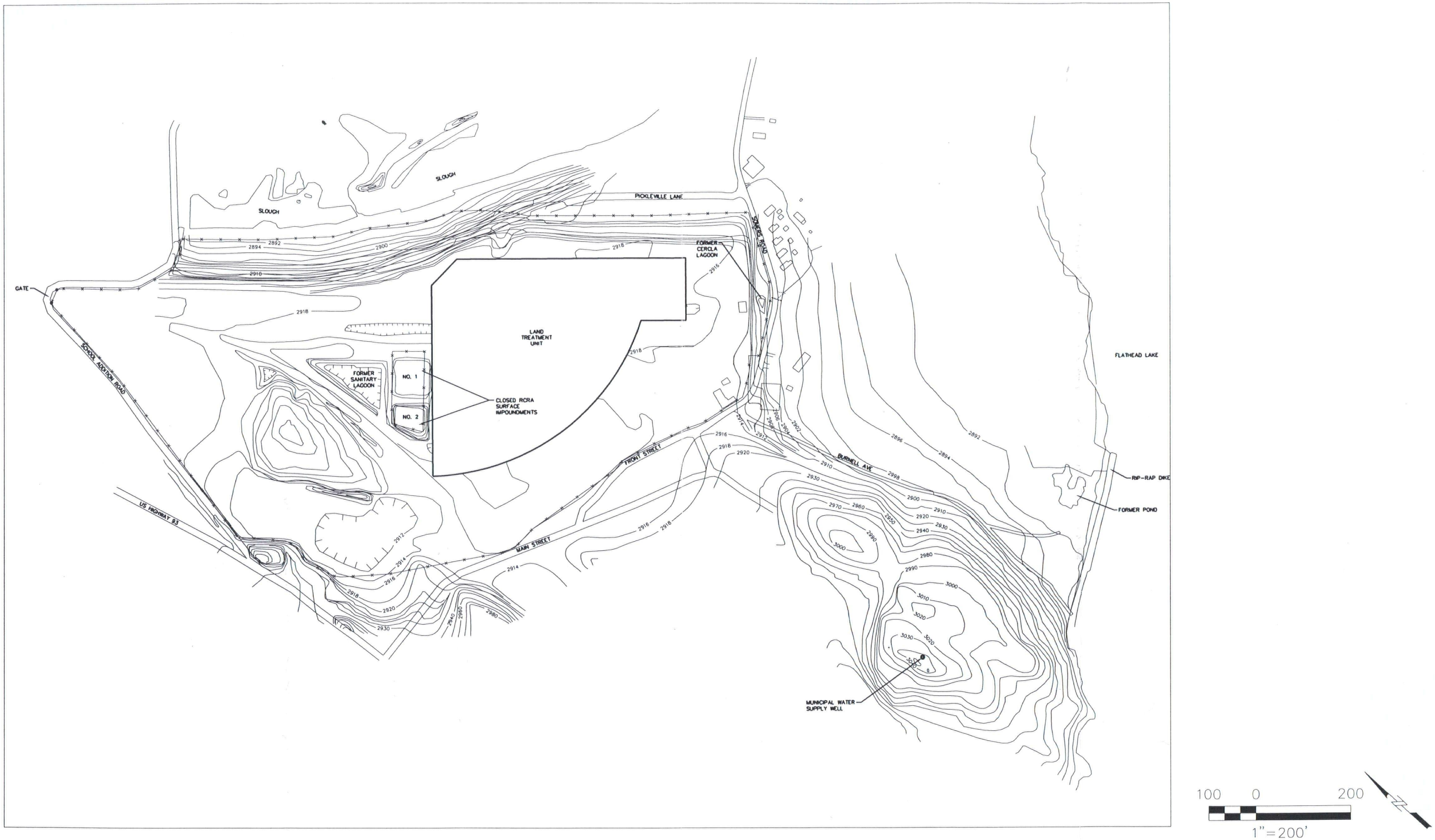
1"=300'

N

BNSF

ThermoRetec

CONTROLLED GROUNDWATER USE AREA PETITION				SITE LOCATION MAP
BN080-01860-250				BNSF - SOMERS, MT
CURRENT DATE	11/21/01	CADD FILE	Fig1	FIGURE 1

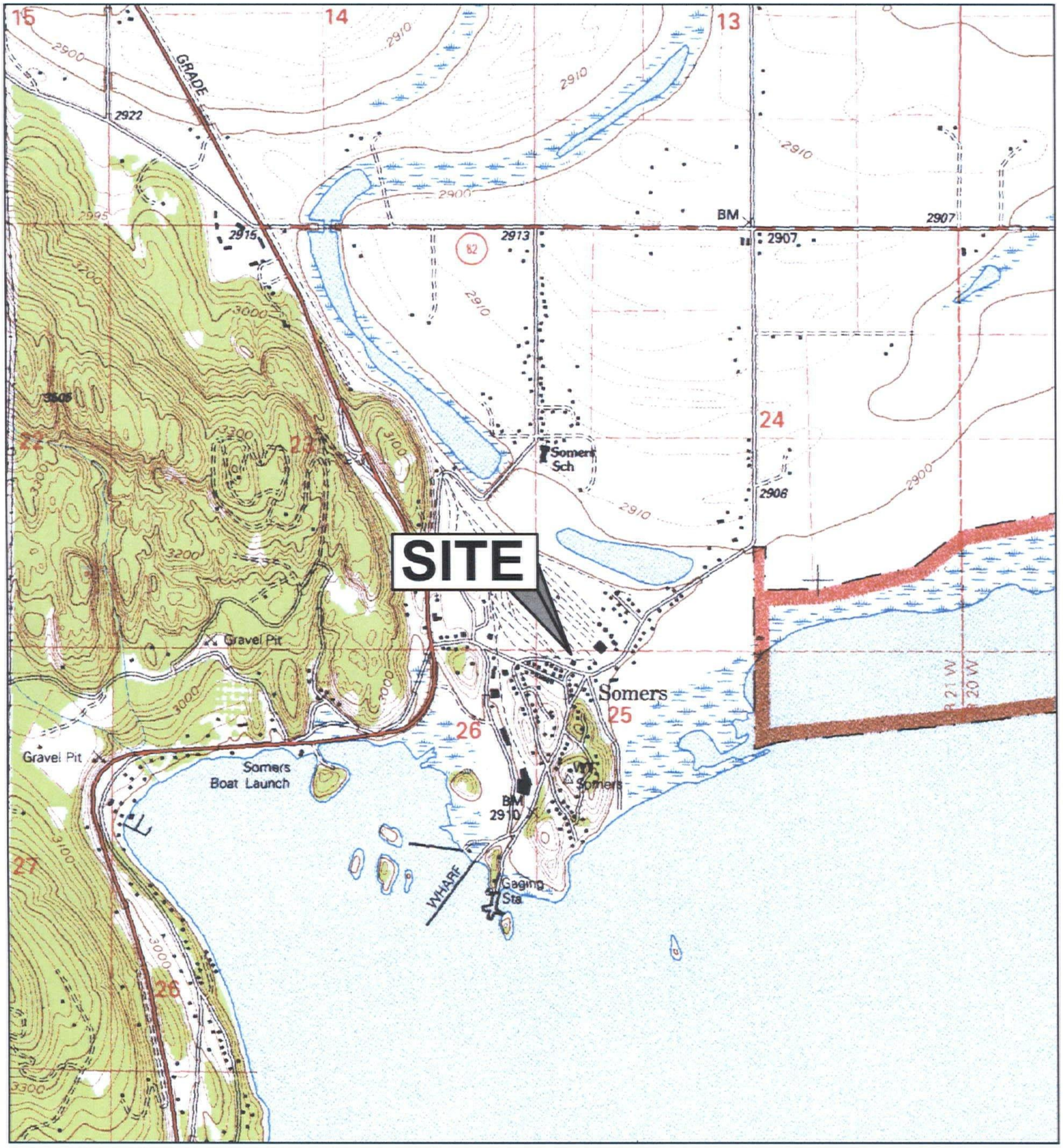


ThermoRetec

BNSF

Burlington Northern Santa Fe Railway

CONTROLLED GROUNDWATER USE AREA PETITION BN080-01860-250				SITE TOPOGRAPHY BNSF - SOMERS, MT
CURRENT DATE	11/21/01	CADD FILE	Fig2	FIGURE 2



SCALE 1:24000

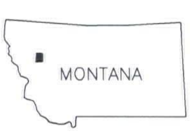
1 1/2 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

NATIONAL GEODETIC VERTICAL DATUM OF 1929

UNITED STATES GEOLOGIC SURVEY
SOMERS QUADRANGLE
SOMERS, MONTANA

7.5 MINUTE SERIES (TOPOGRAPHIC)

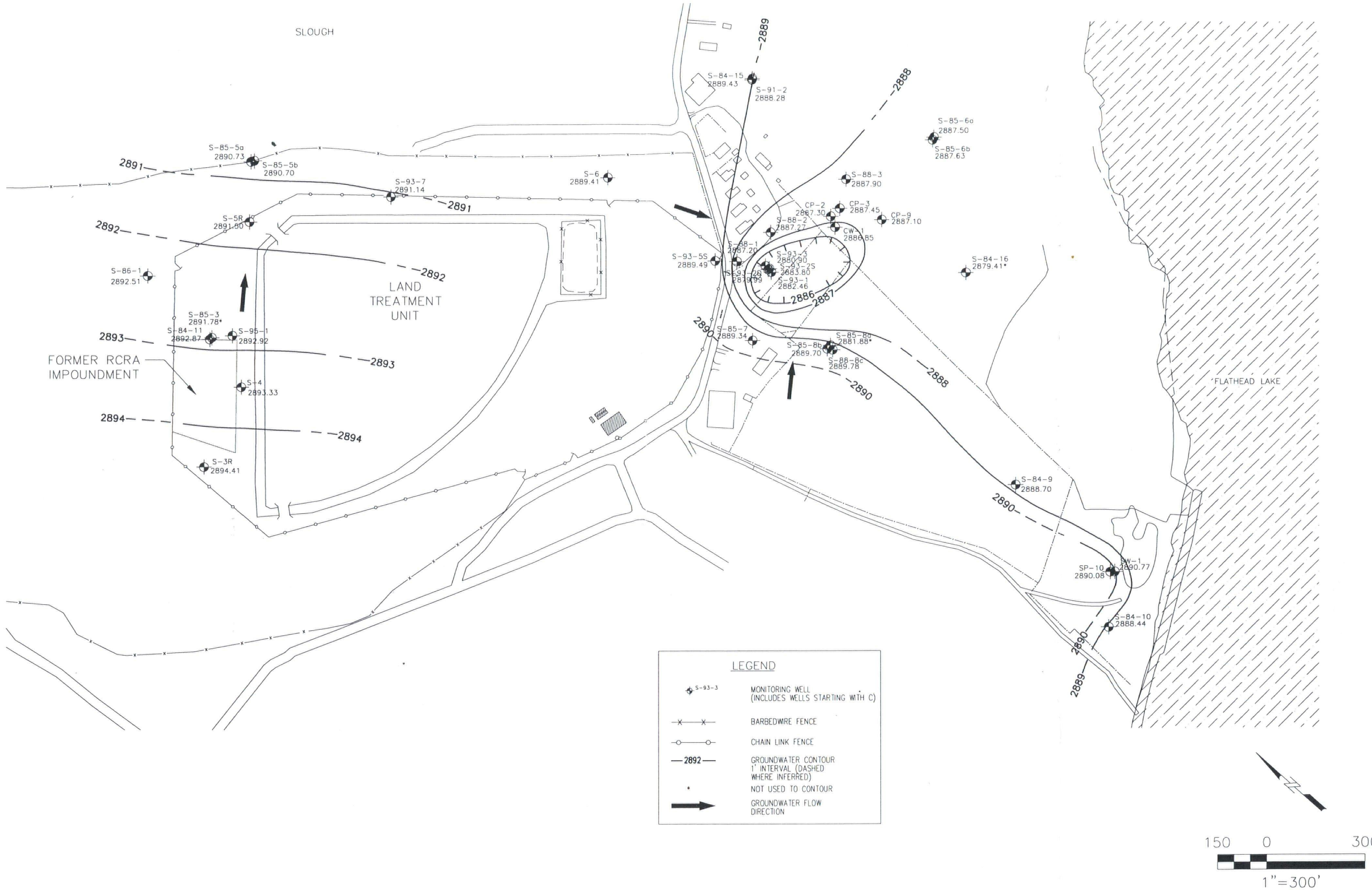


QUADRANGLE LOCATION

ThermoRetec

BNSF

BNSF SOMERS, MONTANA BN080-01860-250		**US GEOLOGICAL SURVEY QUADRANGLE MAP**
DATE: 11/21/01	DRWN: BJB	FILE: Fig3
		FIGURE 3



ThermoRetec

BNSF

CONTROLLED GROUNDWATER USE AREA PETITION BN080-01860-250	POTENTIOMETRIC SURFACE MAP SEPTEMBER 2, 2000 BNSF - SOMERS, MT
CURRENT DATE 9/05/01 CADD FILE Fig4	FIGURE 4